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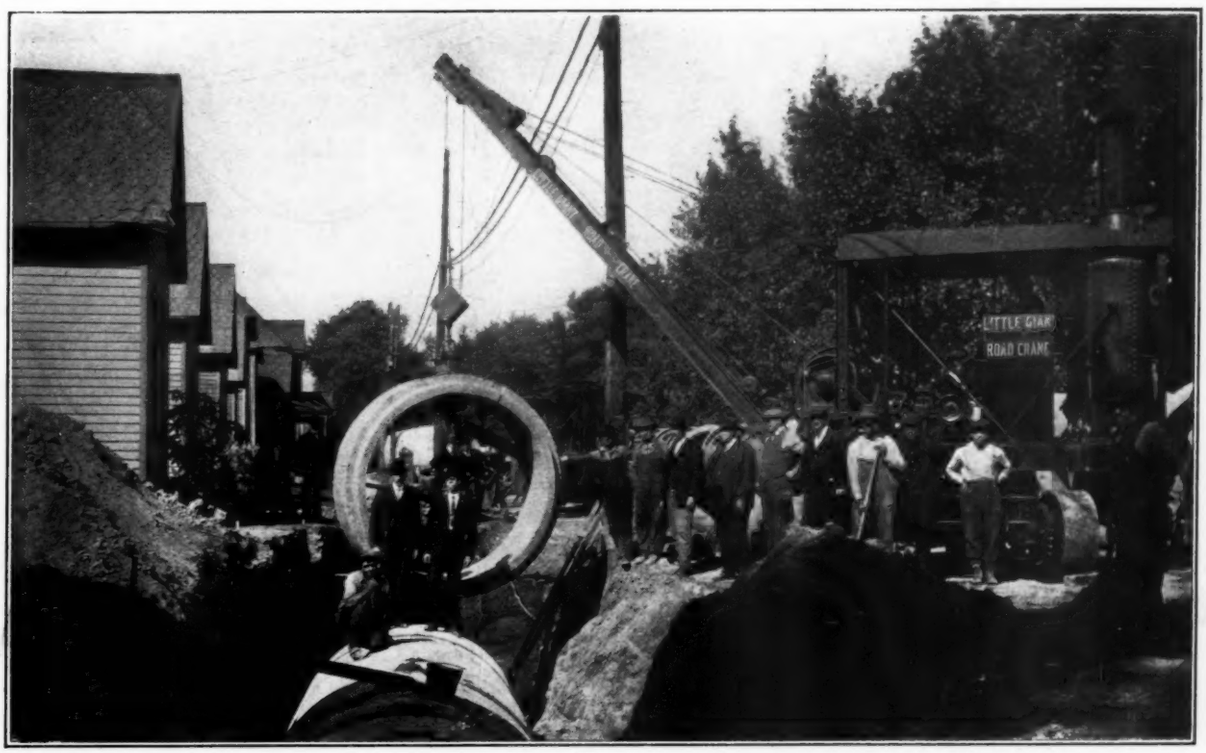

LOWERING INTO TRENCH 4-FOOT SECTION OF 84-INCH PIPE, WEIGHING ABOUT 10,000 POUNDS

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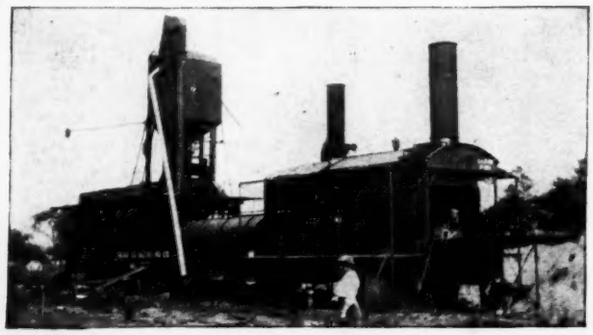

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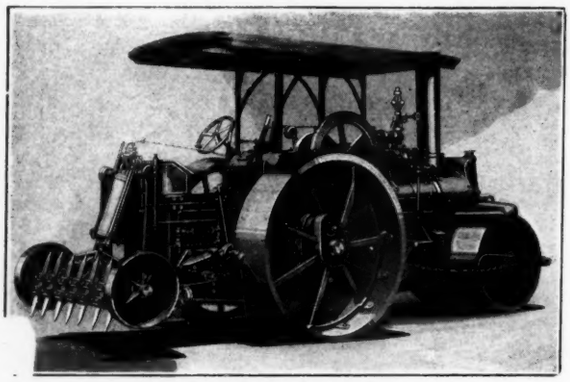

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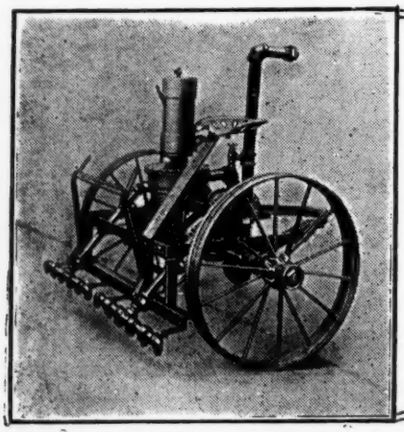

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Sewer Construction in Kokomo, Ind.

Manufacture and installation of about 58,000 feet of reinforced concrete pipe up to 84 inches diameter. Fifteen 4-foot lengths of 84-inch pipe weighing about 10,000 pounds each laid in six hours.

About one-half of the six square mile area of Kokomo, Ind., will be drained by three sewers, the contracts for which have been let, and one of which is now under construction. The contract for the Conkle sewer, the maximum diameter of which is 39 inches, has been awarded to Peter Frandzen, Kenosha, Wis., but construction on it has not yet been commenced. Contracts for the $185,000 Beal sewer of 72 inches maximum diameter and for the Washington street relief sewer of 84 inches maximum diameter have been awarded to Edward Conricote, Youngstown, O., for $185,000 and $315,000, respectively, and work was commenced last October on the construction of the Washington street sewer, on which there had been installed up to December 17, 1,000 linear feet of the 84-inch pipe.

The specifications for the sewers covered segmental block, reinforced concrete pipe, and monolithic construction, offered as alternatives, all of circular cross-section. The contracts were awarded for bids specifying concrete pipe as manufactured by the Independent Concrete Pipe Co., Indianapolis. The work is being done under the authorization and supervision of President Danner, consulting engineer Davenport, of the Board of Public Works, the portions of it extending to the outlets beyond the city limits being in charge of County Surveyor Ellsworth Hunt.

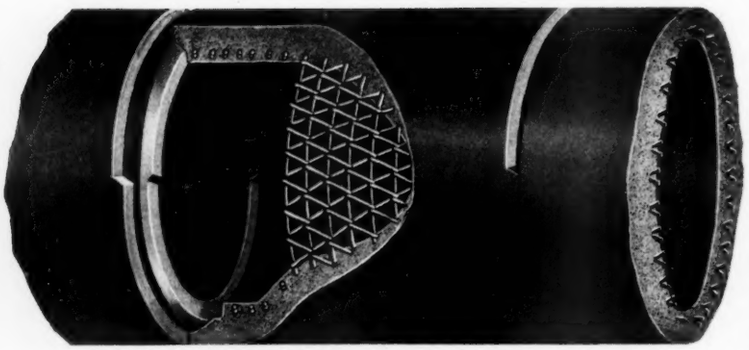
The Conkle sewer comprises 5,980 feet of sewer 8 inches in diameter and 1,068 feet of sewer 39 inches in diameter, together with lengths of 132 to 2,891 feet of most of the various sizes intermediate between these limits. The Beal sewer consists of 9,243 feet of 8-inch sewer, 1,084 feet of 72-inch sewer, and from 147 to 4,493 feet of 15-inch, 18-inch, 24-inch, 27-inch, 33-inch, 36-inch, 48-inch and 84-inch sewer. The smallest diameter of the Washington street sewer is 18 inches, of which there is 1,228 feet and from 237 to 3,584 feet each of most of the intermediate sizes up to 84 inches in diameter. The combined lengths of all the different sizes of the three sewers is 57,995 linear feet.

CASTING 8,300 FEET OF 72-INCH CONCRETE PIPE

DETAILS OF PIPE AND JOINTS

The make of pipe adopted has a slightly tapered hub and spigot joint, made entirely within the thickness of the walls, which varies from about 2½ inches for 24-inch pipes, to 8 inches for 84-inch pipe. The joints are so constructed that below the spring line they are filled with mortar applied from the interior and above the spring line are filled with mortar applied from the exterior of the pipe.

Pipes 42 inches and less in diameter are reinforced with one ring each of American Steel & Wire Co.'s triangle mesh fabric having a cross-sectional area per foot of from 0.068 to 0.153 square inches. For larger pipes up to and including 84 inches in diameter, the reinforcement consists of two rings of the same fabric, the cross-



REINFORCED CONCRETE PIPE WITH SPECIAL JOINT

sectional areas varying from 0.107 to 0.208 square inches.

The 1:2:4 concrete used in the pipes is made with Portland cement, clean, well-graded sand containing not more than 5 per cent of loam, and free from all alkali or organic matter, and clean, crushed stone having a specific gravity of not less than 2.5 and, for all except the 78-inch and 84-inch diameters, of a size to pass through a ¾-inch ring.

MANUFACTURING THE PIPE

The manufacture of the pipe for the three contracts will require about 2,800 yards of sand, 5,500 yards of broken stone or gravel and 9,200 barrels of cement. On the Washington street job the pipe is made in the street where it is to be laid, by a mixer plant moving along the line sufficiently in advance of the trenching and installation operations to permit the pipe to be properly seasoned before it is handled.

Cement, which is delivered daily to the mixer, is of the Universal brand and the Hoosier brand, the latter made by the Indiana Portland Cement Co. at their Greencastle plant, which has been only about a year in operation. The sand and gravel are furnished by the Daker Gravel Co., Noblesville, Ind., and by the Richmond, Ind. plant and the Greenville Gravel Co.

Broken stone, delivered on trucks by the Kokomo Stone Co., is a local product, satisfactorily tested for quality at the Lewis Institute, Chicago. The size, however, is so uniform that there is rather a high percentage of voids, which has been overcome by making the aggregate half stone and half gravel.

The mixing is performed so carefully that an average day's run, requiring 470 sacks of cement, will not vary more than 4 to 6 sacks from the theoretical amount. The concrete is mixed in a Wonder machine manufactured by the Waterloo Construction Machinery Co. The mixer, truck and all, is mounted on an elevated platform built on another truck with which the outfit is moved ahead as required. The mixer is equipped with power-elevating charging hopper operated on an extension track long enough to permit it to be lowered to the ground and filled by wheelbarrows and then hoisted to such a height that the mixed concrete can be spouted directly into the pipe forms, which are 4 feet high. Special care is taken to avoid an excess of mixing water, and only enough is used to make a workable mix of very light consistency, which is constantly watched while the mixer is in operation so that the product is very uniform.

The cylindrical steel sheet forms 4 feet high are reinforced with vertical angles and circumferential tees and are provided with top and bottom cast iron rings. They are assembled in rows on the street and the concrete machine moves along the line filling one after another as it advances. The reinforcement fabric, overlapping 8 inches at joints, is spaced 1¼ inches from both inside and outside walls, and is held in accurate position in the forms by wooden spacers that are removed as the concrete is placed around them.

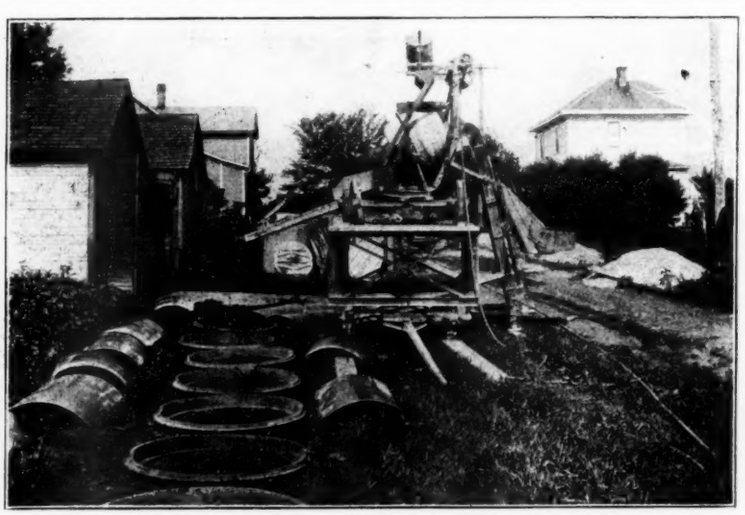
The mixer delivers the concrete directly to a platform on top of the pipe form, from which it is scraped by hand into the annular space between the outer and inner cylinders, in which it is thoroughly spaded to release any confined air and secure maximum density.

For three days the pipes are kept moist by frequent wettings with a hose, and after they are sufficiently set are tipped over into horizontal position and rolled into the gutter, where they remain with minimum obstruction to traffic until they are laid in the trench.

The plant has a capacity for 32 feet of 84-inch pipe, 100 feet of 39-inch pipe and 54 feet of 72-inch pipe daily, stripping the pipes about 24 hours after they are cast. They are generally from 10 to 15 days old when installed in the trench, but sometimes are 30 to 40 days.

TRENCHING

Washington street carries the heaviest traffic in the city on a brick pavement 36 feet wide between curbs. The sewer trench on the center line



BOTTOM RINGS SET TO RECEIVE STEEL PIPE FORMS

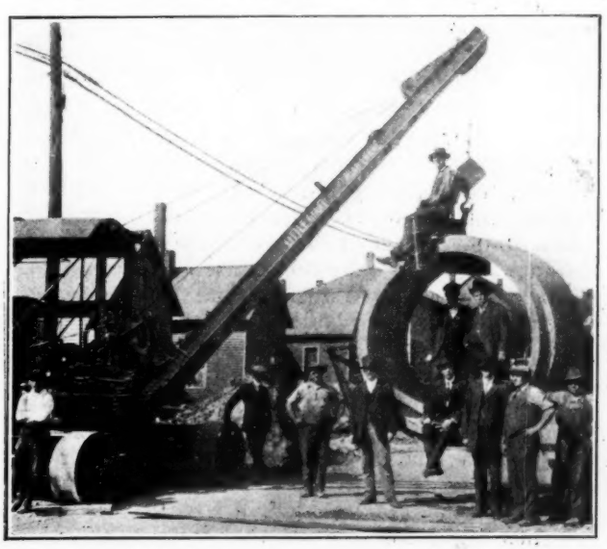
of the street has a maximum depth of about 20 feet and a width of about 11 feet. Although the soil encountered is a stiff, blue clay that can easily be cut and handled and that will stand up without sheeting, considerable difficulty has been encountered on account of the presence, 4 feet each side of the trench, of large water mains and of a large number of service pipes. The excavation is made to a depth of about 16 feet by a model 4 Keystone steam shovel, while a ¾-yard Lakewood clam-shell excavating bucket operated by a Little Giant 4-ton road crane manufactured by the Locomotive Crane Co. of Champlain, Ill., completes the excavation below the 16-foot level. All the spoil not required for backfill is delivered directly to dump wagons, which haul it a short distance to spoil banks along Deer creek, where it is used as fill for making city park improvements.

PIPE LAYING

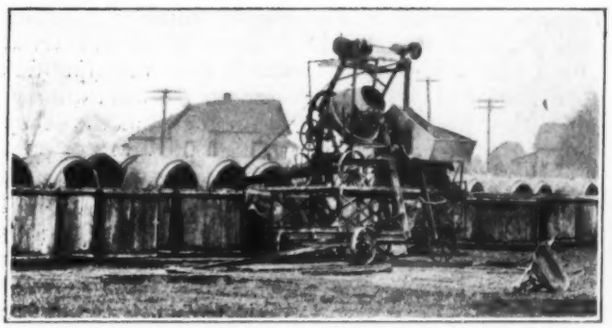
The weight of the pipes per linear foot is approximately 580 pounds for the 39-inch, 1,750 for the 72-inch and 2,340 pounds for the 84-inch sizes, making sections weigh up to about 10,000 pounds. The sections are rolled by hand from the curb to the trench, and lowered to position by the road crane equipped with a special hook or goose neck (shown in the illustrations), which is made either of cast steel or of I-beams bolted together.

The pipe is lowered in the trench and the end is inserted in the end of the pipe already assembled, after which it is carefully aligned and adjusted on the trench bottom and the joints are rapidly made by a workman with a bucket of mortar and a trowel, who first seals the invert half from the inside and then completes the work by filling the upper half from the exterior.

During the early part of December the 84-inch pipe was laid at the rate of 20 to 30 linear feet per day, but on one occasion 60 feet of 84-inch pipe was laid in 6 hours and it is believed that 90 feet of the same size could be laid in one day if the trench was prepared to receive it. An important feature of the work is that the trench is backfilled immediately after each joint is sealed, the backfilling being maintained so close to the end of the pipe that there is ordinarily not more than 20 to 25 feet of trench left open at any one time, thus minimizing the obstruction to traffic.



HANDLING PIPE SECTIONS WITH GOOSE NECK·LIFT



FILLING PIPE FORMS FROM MIXER MOUNTED ON MOVABLE ELEVATED PLATFORM

Development of the Port of New York

At a meeting, December 15, of the New York Chapter of the American Society of Civil Engineers, a paper on "The Port of New York—The Problem," was represented by B. M. Cresson, Jr., consulting engineer of the New York-New Jersey Port and Harbor Development Commission, which is investigating the problem of improving harbor facilities.

He discussed the lack of central administration of this total plant for the principal elements of commerce, railroad and steamship traffic of the country where more than $150,000,000 have already been expended in building docks, piers and harbor facilities. These have no continuity of administration and no co-ordination of plans for the interests that are divided by the imaginary lines between the states of New York and New Jersey, which condition is aggravated by the fact that in the latter state the jurisdiction of the water front is divided between perhaps 40 separate localities. These and other conditions make New York a port of individual endeavor, so far without any general comprehensive plan of development. This applies not only to the railroads with their multiplication of separate costly facilities, but to the steamship terminals and to the lighterage and trucking facilities and even to the warehouses.

There has now been appointed by New York and New Jersey an interstate commission to study the port problem as a whole without respect of the political boundary line. This work is difficult and elaborate and will require a great deal of investigation and analysis which will include the consideration of barge canal terminals for the port, canals and waterways, private terminals, stevedoring operations, tariffs, charges and rates, ferries, handling of fuel, handling of grain, handling of building materials, channels and dredging, banking and commercial operations, electric power supply and other features.

The joint commission has recommended the

legislative enactment of a treaty binding together all parts of the Port District to be administered by a port authority. Under it the municipalities will be adequately protected in the investments that they have made and in the facilities that they have created. There is to be no pledging of public credit for the development of future facilities but merely the creation of a central body with sufficient authority and power to encourage private or public initiative to construct modern terminals as part of an organic whole. It will form a medium under which funds can be raised without respect to the debt limit or the borrowing capacity of any of the component parts of the port district.

New York's problem is not local. It passes under normal conditions half of the foreign commerce of the United States.

There is danger that unless the component parts of the port cease wrangling among themselves and get down to consideration of the development of the port as a business entity, that the Federal government may step in and the control of the port be changed from local to national. It seems likely that such a situation, which would surely be affected by political changes and by the jealousies of other ports and sections of the country, would not solve the problem so well as if the control and administration of the port were retained within the Port District where there is local knowledge and local pride, and under which it is probable that the best results could be achieved not only for the port itself but for the entire nation.

Changes in New York's Building Zones

By Edward M. Bassett*

The Greater New York building zone law has been in operation since July 25, 1916—about four and one-half years. The protective requirements are shown on three maps, known as height, area (or bulk), and use maps. The charter provides that changes in the maps can be made by the Board of Estimate. The aggregate changes are extremely small in area, showing the remarkable permanence of the protection of the zoning system. All the changes made since its adoption affect only about 1⅓ per cent of the total city area zoned. On account of war conditions and decrease of construction the use map changes are the greatest. These are 1/99th of the whole area. Area map changes are 1/335th and height map changes are 1/1000th of the whole area.

In the years 1916-1919, inclusive, ninety-three applications for changes were granted by the Board of Estimate and seventy-two were denied. In 1920, twenty-seven were granted and about the same (the precise number not yet ascertainable) were denied. These figures tend to show that changes are not easily obtained. This is as it should be, because when an owner builds according to the zoning requirements he ought to be protected against easy changes of surrounding requirements.

The total map changes since the beginning (1916-1920, both inclusive) have been one hundred and twenty. There were four in 1916, forty-three in 1917, twenty-six in 1918, twenty in 1919 and twenty-seven in 1920. The small number for 1916 was due to the law being in operation only five months and the possibilities of change not being widely understood. In 1917 the peak of changes was reached, and in succeeding years only about one-half as many changes were made each year. It would appear from this that during the last three years the map changes were fairly proportioned to the normal growth and change of the city.

Use map changes were one hundred and seven, area map ten, and height map three. It is quite possible that as the amount of new construction increases, more changes proportionally will be made in the area and height maps.

In 1916 the four changes all relaxed the restrictions; in 1917, thirty-six relaxed and seven strengthened the restrictions; in 1918, twenty relaxed and six strengthened; in 1919, thirteen relaxed and seven strengthened; in 1920, twelve relaxed and fifteen strengthened. In other words, in 1916 there was no strengthening, in 1917 the strengthening as compared to relaxation rose to 19 per cent, in 1918 to 30 per cent, in 1919 to 54 per cent and in 1920 to 125 per cent, when for the first time the strengthening changes exceeded the relaxing changes. These figures showing relaxation and strengthening are most gratifying. They show not only official support of the zoning system, but they show clearly that property owners are gradually favoring the strengthening of the zoning requirements rather than their relaxation.

The building zone system of New York may be deemed a success. Other cities, which have recently adopted it or are preparing their maps, may well be encouraged by the experience of New York.

*Counsel, New York City Zoning Committee.

A Traveling Gravel Plant

A product of about 300 yards of gravel and sand per 9-hour day is secured from a simple traveling plant installed in a gravel pit by W. C. McLeod, Livingston, Mont. A 14-D Bucyrus revolving steam shovel with caterpillar traction moves along the base of the gravel and sand banks on 6-inch blocking that raises it high enough to deliver 18 feet above the ground to a grizzly over the top of a movable storage hopper from which the gravel is delivered to trucks underneath while the oversize rejects from the grizzly are spouted to waste or into wagons alongside.

The storage bin is mounted on skids and is attached by a chain to the steam shovel which hauls it along as it advances. The steam shovel consumes about 2,000 pounds of coal per day and furnishes sand for use in the construction of concrete pavements for the city of Livingston.

Flexible Pavement Bases

Advantages of such bases as indicated by experience and by tests on large slabs and beams explained by Prevost Hubbard. Asphalt concrete base shown to have high slab and beam strength.

In a paper read last December before the Engineers' Club of Philadelphia, Prevost Hubbard, chemical engineer for the Asphalt Association, gave particular prominence to the applicability of flexible types of construction for pavement base as compared with the more rigid type of which the cement concrete base is the most common illustration.

Almost any well-compacted soil will of itself support the heaviest conceivable traffic if its moisture content is so controlled as to make its supporting power a maximum and if the pressure is transmitted by a structure which prevents the displacement of particles at the surface. Some soils are so affected by moisture and so retentive of moisture that reaches them that, if it is impossible to exclude moisture from them when serving as pavement sub-grade, it is desirable to modify the character of the material by adding to it sand or other materials. "It is evident that in many cases it will cost far more to increase the thickness of a pavement to such an extent that it will distribute the load sufficiently to enable a poor sub-grade to support it, than it would be to change natural sub-grade conditions so as to create a high supporting value for the relatively thin pavement."

Rigid foundations are claimed to have a bridging value, although "as a matter of fact no practicable design of highway for modern heavy traffic permits the assumption of more than a temporary bridging action over appreciable areas of a weak sub-grade."

Most engineers, especially in the east, continue to employ rigid foundations on this theory of bridging action, although considerably over 12 million square yards of flexible type of construction as represented by asphalt base pavement are now giving satisfactory service in California and Oregon, many of them five inches or less in total thickness and subjected to heavy motor truck traffic. Some of these pavements have been in service for over 20 years with little or no cost for maintenance. In addition, there are in Washington, D. C., Chicago, Omaha, Pittsburgh, Buffalo and Denver sections of bituminous base which have given satisfactory service for over 20 years, these showing that serviceability of this type is not restricted to any one locality.

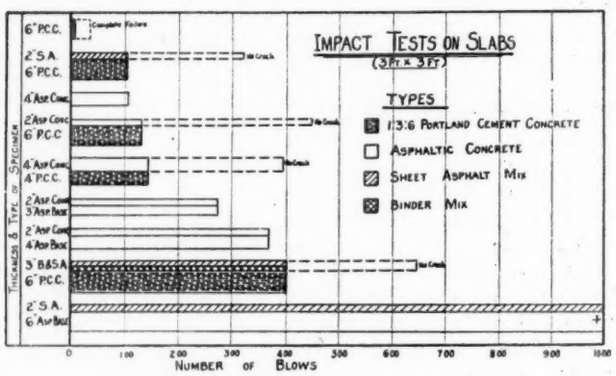
Before following the precedent set by these examples, it is, of course, necessary to understand the engineering principles of their operation and service. "Some degree of cushioning effect under traffic has been claimed and admitted for the asphalt base as well as for the wearing course, but few engineers have believed that a mineral aggregate cemented together with asphalt could possibly possess any degree of slab strength or beam strength, at least to an extent comparable with the rigid type of construction." In order to demonstrate this and to obtain some definite figures for comparison, an investigation has been begun under the direction of Mr. Hubbard, assisted by W. E. Rosengarten, traffic engineer of the Asphalt Association. The experiments of the Bureau of Public Roads (previously referred to in PUBLIC WORKS) have already shown that impact rather than dead load is the destructive factor on the highways and "it was therefore decided to limit these investigations to a study of the effect of impact upon test specimens having thicknesses equivalent to those commonly used in the construction of highways. It was clearly realized in advance that it would be impossible to duplicate all of the variable conditions under which impact is delivered to a pavement by traffic and it was therefore decided to confine this study to the effect of pure impact as delivered by an iron ball falling from a relatively small height. The results here reported are only a portion of those included in a more comprehensive investigation involving other comparisons which will shortly be presented in a detailed article.

"In order to obtain comparisons at two extremes of conditions, it was decided to construct and test slabs of various design upon a solid uniform sub-grade and to test beams of the same design supported only by knife edges. A plot of ground was secured and upon this was laid a six-inch course of cinders thoroughly compacted by rolling. Slabs three feet square were constructed directly upon this sub-grade except that, after the forms had been placed, the sub-grade within the forms was leveled up with a very thin layer of sand so that each specimen would have a uniform thickness throughout. Portland cement concrete slabs were cast four and six inches thick of a 1:3:6 mix. These were cured under a cover of moist sand after they had set. Some of the concrete slabs were then covered with from two to four inches of coarse graded aggregate asphaltic concrete and some with sheet asphalt with and without a binder course. In addition, slabs were constructed of asphaltic concrete base mixture

and covered with either asphaltic concrete surface mixture or with sheet asphalt so as to produce total thicknesses directly comparable with the Portland cement concrete base specimens. At the same time, corresponding sets of beams four feet long and ten inches wide were constructed of the same type and thickness. In general the specimens were tested when the concrete was 28 days old, although in a few cases they were slightly older when, for one reason or another, it was found impossible to keep up with the testing schedule which had been planned.

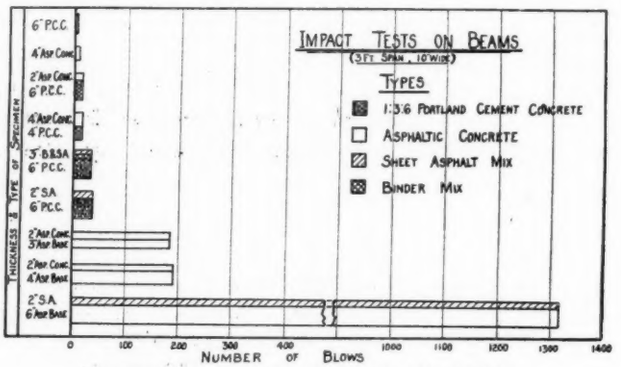
All slabs were tested where they had been cast by means of a machine which was designed and operated so as to drop a 125-pound iron ball upon the center of the upper surface from a height of six inches at the rate of about 30 blows per minute. In all cases a specimen was considered to have failed when the first crack appeared. Cracks in the Portland cement concrete were invariably first noted developing on one or more sides of the specimen from the plane of contact with the subgrade. Under continued impact these cracks traveled to the upper surface of the monolith and then across the upper surface toward the center. The all-Portland cement concrete specimens broke into two to four large fragments shortly after the first crack appeared, while similar slabs with an asphalt top showed no cracking of the top after the base had failed. The results obtained on check specimens were in some cases erratic, in others quite close together. By averaging results, however, the general trend is apparent and is closely borne out by results obtained on the beam specimens.

The following diagram shows the resistance to impact of the various types of slabs as measured by the number of blows required to produce failures. The dotted extensions of the asphalt tops on slabs with a Portland cement concrete base show the number of blows at which the test was stopped, no failure of the top then being apparent.



RESULTS OF IMPACT TESTS ON SLABS

The beams were tested upon steel knife edges three feet apart with the same machine used for testing the slabs but with a 50-pound iron ball dropped from a height of 1½ inches at the center of the span at the rate of about 50 blows per minute. The number of blows required to produce the first crack was recorded as point of failure. In all beam tests complete failure occurred within a very few blows after a crack appeared. The results of these tests are shown in the second diagram in the same manner as the slab tests.



RESULTS OF IMPACT TESTS ON BEAMS

In considering these diagrams no attempt will be made to draw conclusions based upon a comparison of absolute values as here shown. In fact, it is frankly admitted that such a course would be unwise until many more test data are available. It is believed, however, that the general similarity in trend of the results obtained in both the slab and beam tests is highly significant and points to interesting facts. What is clearly apparent for conditions under which these specimens were tested may be summed up as follows:

Asphaltic mixtures develop very decided slab and beam strength as measured by their resistance to impact. The all-asphalt type of slab and beam appears to offer considerably more resistance to impact than an equivalent thickness of 1:3:6 Portland cement concrete considered either as an integral structure or as a base for an asphaltic top.

It is recognized that, unsupported by practical service results, deductions drawn from these tests might not be conclusive as applied to the design of highways for heavy traffic. They do, however, help to explain the remarkably satisfactory service record of the millions of square yards of 4 and 5-inch asphaltic concrete pavements in California and Oregon and point the way to a more rational development in the design of highways in other localities.

In summing up the substance of this paper, there are a few points which the writer wishes to emphasize:

1. Any rational design of highway should take into account the fact that the sub-grade must ultimately take the weight and shock of traffic as transmitted through the pavement, and practically any reasonably dry sub-grade will do this if it is compacted and its surface is protected from displacement. Careful attention to sub-grade preparation and drainage is therefore the first essential to be considered.

2. The asphaltic concrete pavement is highly resistant to impact, which is recognized as the most destructive traffic factor, and under impact develops as a single unit relatively high slab and beam strength.

3. It is manifestly uneconomical if not imprac-

ticable to adopt a design of highway that will permanently bridge appreciable areas of weak sub-grade. While the asphalt type develops bridging action to an appreciable extent, it will of itself constantly seek to maintain contact with the sub-grade at all points and thus reinforce itself with the maximum supporting value of the sub-grade. The rigid type of pavement or base cannot do this because of its inherent characteristics. It is therefore almost sure to crack eventually where appreciable areas of sub-grade fail to support it uniformly.

4. Both the service history of asphalt-base pavements and the test data here presented indicate that under given conditions it is not necessary to adopt so massive a design for the flexible type of base as for the rigid type. It is difficult for engineers who have had no opportunity to observe the asphalt-base pavement under heavy traffic to think of it in terms of less thickness than the rigid base, but in the light of present experience such consideration appears to be entirely warranted.

City Planning For Kansas City

Kansas City, Mo., has a planning commission, and this commission has chosen a professional city planner to advise it. Kansas City, Kan., also has a city planning commission, and this commission also has chosen a city planner. There is little besides political boundaries to separate the one Kansas City from the other, and from every practical point of view it is desirable that the planning of the two cities should be carried on as a single problem. It is therefore fortunate that the planning commissions of both cities should have chosen the same city planner, George E. Kessler. It seems probable that Mr. Kessler will be given authority to consider as one problem the planning not only of the two cities, but also of the area within a five-mile radius of the greater city. With the growth of the cities their inter-relation and inter-dependence will necessarily become closer. Street alignment and grades, bridges, street car traffic and possibly park systems and other features can be designed to much greater advantage if they are not limited in either case by the political boundaries of the cities, but may be developed without regard for such boundaries.

New York City's Preparations For Snow Removal

One thousand men of the Police, Fire and Street Cleaning Departments of New York City are now being trained to handle the 50 caterpillar tractors recently purchased to keep the streets clear of snow the coming winter. They are instructed in driving, lubrication and maintenance, with the idea of providing plenty of competent operators, no matter what emergency comes up.

The tractors will be stationed in fire engine houses, located at strategic points about the city, so that at the first snow fall, during the day or night, they can be promptly put to work.

The schools of instruction have been established under the supervision of Mr. E. H. Bate, service engineer of the Holt Manufacturing Company. During the past month some 900 men have learned to drive and 700 of them have received instruction in lubrication. Owing to the ease of driving a caterpillar and keeping it in good working condition when the instruction work is completed, New York City's snow removal equipment and operating personnel will probably be second to none in the world.

Pavement Specifications of the A. S. M. I.

Changes under consideration by the American Society for Municipal Improvements in that society's specifications for concrete, stone block, sheet asphalt and brick pavements.

CONCRETE SPECIFICATIONS

The Committee on Specifications of the American Society for Municipal Improvements has submitted to the members a set of specifications for Portland cement concrete pavements which it recommends for adoption in place of those previously adopted by the society. Some of the features of these specifications are as follows:

Proportions of cement and fine aggregate and coarse aggregate to be in the ratio of one part cement to not more than 6 parts of other aggregate, the exact proportion to be determined by screen analysis with a view to obtaining a uniform density. In no case shall volume of fine aggregate be less than ½ the volume of course aggregate, nor the volume of cement less than ½ that of fine aggregate; and a cubic yard of concrete in place shall contain not less than 6 bags of cement.

Steel forms shall be used, well staked or otherwise held to the established lines or grades.

Concrete pavements 20 feet or under in width should be reinforced throughout with a steel fabric having an effective weight of not less than 30 pounds per 100 square feet, members to be at right angles. Reinforcement to be laid with the main members across the pavement. The ratio of effective area across the pavement shall approximate 4 to 1 along the axis of the pavement. The spacing of the main members of the fabric shall not be more than 6 inches nor less than 4 inches. Tie members to be not more than 12 inches nor less than 8 inches.

Concrete pavements wider than 20 feet should be rein-

forced with a steel fabric having an effective weight of not less than 30 pounds per 100 square feet, which shall be increased in weight one pound for each foot of width of pavement up to 50 feet.

Reinforcement shall be placed at right angles to the axis and generally 2 inches below the surface of the pavement. The fabric shall extend to within two inches of the ends and sides of the slabs.

For finishing the concrete, it is provided that it shall be brought to correct surface by means of a screed used with a tamping movement, to be followed by the use of a metal roller, weighing approximately 15 pounds per linear foot of width, worked across the roadway, the surface to be finished by drawing a rubber garden hose or a rubber belt along the surface while still wet. (Apparently a mechanical finisher may be used as an alternative to this method, since the specifications state that: "Should a mechanical finisher be used, care must be taken to keep the mixture sufficiently dry.")

The pavement may be cured by covering with two inches of earth, straw, marsh grass, hay, etc., to be kept wet for at least ten days. Under the most favorable conditions for hardening, traffic shall be kept off the pavement for at least 14 days, and longer in cool weather.

Concrete is not to be mixed or deposited when the temperature is below freezing, and if it should drop to 35 degrees or indications are that it will drop this low within 24 hours, the aggregate shall be heated and precautions taken to protect the work from freezing for at least ten days.

STONE BLOCK SPECIFICATIONS

Modifications in the stone block specifications of the A. S. M. I. include, as an addition, provisions for laying Durax paving blocks, as follows:

Durax paving blocks shall be cut from granite complying with the requirements specified herein for new granite paving blocks. The blocks shall be cubes of granite with six approximately square surfaces, the edges of which measure not more than 4 nor less than 3 inches in length. Thev shall be dressed so as to conform with the requirements specified for new granite blocks except as to form and dimensions. They shall be laid as specified for new granite blocks except that the courses shall be laid in circular concentric arcs with the largest blocks at the center of the arc and the smaller ones at the springing line. The radii of the arcs may be varied from 3 to 7 feet.

Provision is also made in these specifications for a tar and asphalt filler which is described as follows:

The mixture of coal tar pitch and refined asphalt shall be composed of 100 parts of coal tar pitch and 20 parts of refined asphalt. The tar and the asphalt shall each comply with the requirements herein specified in sections 13 and 14, except that the penetration of the asphalt at 77 degrees Fahrenheit shall be not less than 30 nor more than 40. The tar and asphalt filler shall be mixed with sand and used in the same manner as the coal tar or asphalt filler described in sections 13 and 14.

The secretary is also sending to the members to be voted upon a form of specifications for sidewalks and curbs. These include specifications for 2-course concrete sidewalks and 1-course concrete sidewalks; for curbs of granite, hard sandstone, bluestone and hard limestone, soft sandstone and limesone, and of concrete; also for pre-molded reinforced concrete curb. The curb specifications include provisions for setting the curb in concrete or gravel, and the use of drain tile under the curb.

SHEET ASPHALT SPECIFICATIONS

Several changes were recommended in the sheet asphalt specifications. Penetration for light traffic streets was changed from the limits of 55 to 85 to those of 45 to 70, and for heavy traffic streets from 30 to 55 to 25 to 45. A new provision was inserted that "The penetration shall be determined by the engineer within the limits indicated above and shall include a tolerance of 10 per cent either way of the penetration set for the particular street." Another new provision was: "Low spots or depressions in the foundation more than one inch below the grade thereof shall be filled and brought to grade with binder mixture and compressed prior to the spreading of the binder course. Compression must be effected by a roller if depressions are of a sufficient area, otherwise tampers may be employed."

In connection with laying the surface mixture, the following new provisions were inserted:

Loads should not be dumped any faster than they can be properly handled by the shovelers. . . . The shovelers shall not distribute the dumped load any faster than it can be properly handled by the rakers. The rakers will not be permitted to stand in the hot mixture while raking it, except where necessary to correct errors in the first raking. . .

Immediately after raking, the mixture shall be compressed by hot tampers where it adjoins the curbing, gutters, headers, manholes, etc., and in all places inaccessible to a roller. In all other places it shall be given its initial compression by rolling with a tandem steam roller weighing not less than 5 tons, as soon after being raked as it will bear the roller without undue displacement or hair cracking. Delays in rolling the freshly raked mixture will not be tolerated.

Unless otherwise ordered by the engineer, the rolling shall be conducted as follows: The initial compression shall be given by rolling in a direction parallel to the curb, after which the pavement shall be cross-rolled or diagonally and then straight rolled until a compression and contour is obtained which is satisfactory to the engineer. During the initial (and) (or) final compression of the pavement the rollers should preferably be operated at a speed of approximately one (100) feet per minute and when so engaged they will not be permitted to exceed a speed of one hundred fifty (150) feet per minute. Where necessary to moisten the roller to prevent the hot mixture from sticking to it, a mixture of kerosene and water should be sparingly applied to the large roll. With the permission of the engineer, steam or water may be substituted therefor, but the use of water in excessive amounts will not be allowed under any circumstances.

NOTE: Where the width of the street will not permit cross-rolling or where the type of construction renders it desirable, the engineer may change the method of rolling.

Where more than one hundred (100) square yards per hour of surface mixture are laid, two rollers will be required. Where two rollers are employed, a 5-ton tandem steam roller should be used for the initial compression and not lighter than an 8-ton tandem steam roller for the final compression. With the permission of the engineer, a three-wheeled steam roller may be used for the final compression. All rollers used shall be in good condition and shall weigh not less than two hundred (200) pounds to the inch width of tread. They shall be operated by competent and experienced roller engineers and must be kept in continuous operation as nearly as practicable in such a manner that all parts of the pavement shall receive substantially equal compression. During an 8-hour day each roller must be engaged in actual rolling for not less than 6½ hours, not more than 1½ hours being allowed for cleaning fires, watering, etc.

After the pavement has received its initial compression by rolling and before the close of the day on which it was laid, it shall have a small amount of Portland cement or limestone dust swept over it in order to give it a pleasing appearance and color. Except with the permission of the engineer, this shall not be done until the pavement shall have been rolled sufficiently to establish it and where back patching will be necessary and until any such defects have been so remedied. In no case shall the sweeping of cement

be carried on in such a manner as to permit the dust from it to blow or be carried on to the freshly raked mixture before it has been rolled.

Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to insure a thorough and continuous bond between the old and new surfaces. Except when a rope joint is used, the edge of the old pavement shall be cut back on a bevel so as to expose a fresh surface after which the hot surface mixture shall be placed in contact with it and raked to a proper depth and grade. Hot smoothers (and) (or) tampers shall be carefully employed in such a manner as to heat up the old pavement sufficiently to insure a proper bond without burning it.

The finished pavement shall have a contour substantially conforming to the grade set by the engineer and shall be free from any depressions which will hold water or which exceed three-eights (⅜) of an inch in depth as measured between any two points six (6) feet apart in a line conforming substantially to the grade and contour as set by the engineer. It must be free from porous or rough spots that will remain wet after the balance of the surface has dried.

Provisions were also added as to the kind of plant that may be used for manufacturing the pavement material and the testing equipment that must be provided, these requirements being as follows:

Plant.—The plant used in manufacturing the pavement must be of the batch type and capable of mixing in the manner herein specified not less than 80 tons of surface mixture per day of eight hours and must be provided with separate chambers for heating and mixing the ingredients. The mixing shall be done in a twin-shaft mixer of the pugmill type capable of holding and properly mixing not less than a 750-pound batch of surface mixture. Each plant must be provided with asphalt kettles of such capacity that one filling of them will be sufficient for a day's run. There shall also be provided a 6- or 8-mesh rotary screen not less than 6 feet long, capable of separating the coarse and fine aggregate and delivering each to a separate compartment bin; bins and screen to be provided with overflow pipes. The hopper into which the hot aggregate is drawn from the bin must rest upon a set of scales so arranged that a definite weight of material can be weighed out of the bin and delivered to the mixer.

The asphalt bucket used to measure and apply the asphalt must be balanced upon a set of scales and so arranged that the asphalt can be easily and quickly weighed and be applied in a thin sheet the full width of the mixer.

The plant shall be provided with an asphalt thermometer for the melting kettles, an electric pyrometer at the discharge chute of the drier, a platform scale and at least two inspectors' armored thermometers.

The different kinds of sand and stone used shall be kept separate and such provisions as are deemed necessary by the engineer to keep them from becoming mixed shall be made by the contractor.

Testing Equipment.—The contractor shall provide and maintain in good order at the plant the following testing equipment, which may be used by the engineer or an inspector designated by him to determine the penetration of asphalt and asphalt cement, the grading of the mineral aggregate and such other tests as are deemed necessary.

1 penetration machine with needles, glass dish and thermometer.

1 set of standard screens, 200, 100, 80, 50, 40, 30, 20 10 square mesh, ¼, ½, ¾, 1, 1½-inch circular openings.

1 laboratory sand scale.

1 roll of manila paper for making pat tests.

All of the above-mentioned apparatus shall be of standard type and approved by the engineer and shall be properly housed by the contractor in a separate building or room not less than ten (10) feet by ten (10) feet and provided with a work-bench. This room shall be used exclusively for testing purposes by the contractor and the engineer or his inspector.

BRICK PAVING SPECIFICATIONS

In the brick paving specifications the additional requirement is that "Adequate under-drainage shall be provided to remove rapidly all water from the sub-grade of the roadway, as provided in the specifications for sidewalks and curbs of the American Society for Municipal Improvements. Where required a similar cross-drain shall also be provided." Another new provision is that "All castings for manholes, catch basins, etc., shall not be imbedded in the concrete foundation. They shall be made to rest on top of the foundation to allow the pavement to expand uniformly, therefore avoiding the cracks and crushing of the bricks."

Provision is proposed for a mortar cushion in the following paragraph:

When properly graded sand cannot be obtained for cushion, the following cushion may be used. The sand and cement in proportion of one part cement to four parts sand shall be thoroughly mixed dry in a small batch mixer until it is of uniform color throughout. The mixture shall then be spread on the prepared foundation to a depth of one inch and shaped with a template to a true cross-section parallel to and four inches below the cross-section of the finished pavement. Bricks shall be laid, rolled and culled immediately following the placing of the sand-cement cushion. After the culling is effected, they shall then be well wet down and grouted as hereinafter specified in section 18-A of these specifications.

The proposed provision for asphalt filler is: The asphalt filler shall be homogeneous, free from water and shall not foam when heated to 200 degrees C (392 degrees F.). It shall meet the following requirements:

(1) Flash point not less than 200 degrees C.

(2) Melting point (ring and ball) 65 degrees C. to 100 degrees C.

(3) Penetration at 25 degrees C., 100 g. 5 sec., 30 to 40 or 40 to 50. Penetration at 0 degrees C., 200 g., 1 minute, not less than 10.

(4) Ductility at 25 degrees C. not less than 2.

(5) Loss at 163 degrees C., 5 hours, not more than 3 per cent.

(6) Total bitumen (soluble in carbon disulphide) uot less than 95 per cent.

(7) Per cent of total bitumen soluble in carbon tetrachloride, not less than 95 per cent.

All of these changes have been submitted to the members under a provision of the society's constitution requiring a letter ballot for their final adoption by the society.

Refuse Collection In England

A few weeks ago the ministry of health of England conducted an inquiry in connection with the request of the borough of Great Grimsby for permission to purchase six electric vehicles for refuse collection and highway purposes and to erect a garage. In this investigation the following facts were brought out:

Refuse is collected from 17,755 houses amounting to 1,429 tons a week. In removing this refuse by horse-drawn vehicles the cost for labor alone had averaged $3.20 a load, a load averaging one ton. (In this article cost figures will be given in dollars on the basis of $5 to a pound.) The cost for the last half of 1920 was $55,000, and adding the destructor cost for burning the rubbish, amounted to one-quarter of the taxes raised in the district. The statement was made in the investigation that refuse collection and disposal in England cost $60,000,000 a year.

The borough surveyor estimated that the cost of running an electric vehicle per year was $350 for current, $185 for tires, $1,450 for interest and replacement, $100 for oil, waste and water, $92.50 for insurance, $967.50 for driver, $2,750 for three fillers; a total cost of $5,895, or $2.56 a ton, which would give a saving of 64 cents a ton. He proposed, after installing the six electric vehicles, to purchase an additional one each half year out of the revenue until they had twelve. The inspector thought the figures given should be modified, 6½ per cent interest on the $47,500 (cost of vehicles) and 7-year sinking fund amounting to $8,550 a year, maintenance of each vehicle $250, current $425 instead of $350, and drivers' wages $1,000 each. This would give the annual cost of the six vehicles, including fillers' wages and other items, as $37,980, or $6,330 each.

Quicksand

What it is and some of the peculiarities of its action in trenches, methods of handling it by bleeding, compressed air and other expedients, and the supporting power of such sand, are discussed by Col. Charles R. Gow.

The nature, behavior and methods of controlling quicksand were discussed by Col. Charles R. Gow, civil engineer and contractor, before the Holyoke convention of the New England Water Works Association. The principal points of Mr. Gow's paper are given in somewhat condensed form in the following paragraphs.

DEFINITION OF QUICKSAND

Mr. Gow began by stating that, contrary to popular ideas, quicksand, strictly speaking, is not a material but rather is a condition of a material which, under different circumstances, may possesses no such characteristics. Moreover, quicksand as such rarely occurs in nature, but usually is artificially produced by excavation or other acts of man. Stories of men and animals losing their lives by being "sucked" into quicksand beds probably have their origin in the mistaken application of the term to deposits of semi-fluid mud, silt or soft clay; also there may be isolated cases in which ground water rises to the surface through beds of fine sand and produces a natural quicksand.

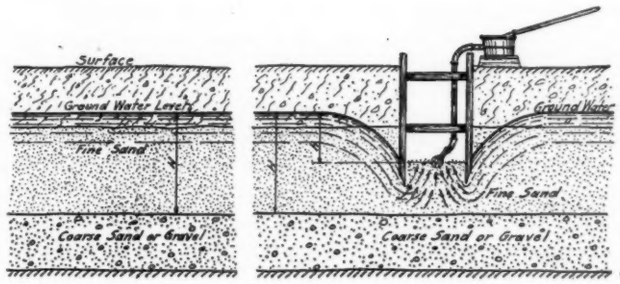
The author of the paper was convinced that fine sands under conditions of quickness act in strict accordance with well-recognized physical laws, and that many of the troubles encountered in operating in quicksand could often be avoided by the adoption of more scientific methods of handling. As perhaps the best and most inclusive definition of quicksand which Mr. Gow had seen, he quotes one given about twenty years ago by Allen Hazen—"A sand containing for the time more water than would normally be contained in its voids and therefore with its grains held a little distance apart so that they flow upon each other readily." When the water and sand are mixed but at rest, the several grains of sand rest one upon another and the voids in the sand mass are identical with those found in dry sand of the same composition, but filled with water instead of air. In order to displace any individual grain it will be necessary to overcome the frictional resistance of that particle upon its adjacent neighboring grains and the adjacent grains must also be displaced more or less in order to free the one in question. To accomplish this will require the application of a substantial amount of force.

When water passes upward through sand, the friction of the passing water upon the separate grains of sand either actually lifts them or tends to reduce the friction of one grain upon another, thus making displacement of the particles much easier of accomplishment. If the velocity of the water be sufficient to bring the particles substantially into a state of suspension, they offer practically no resistance against displacement and a body resting upon such sand will sink into it as it would into a semi-fluid material. In order to possess the qualities of quicksand, the material must approximate this condition.

It will be obvious that the smaller the individual particles of sand the easier it is for the water to lift them and hold them in suspension. Also the voids, generally speaking, will be smaller and more numerous in this case and the passage of water through them more difficult. The result is, therefore, that fine grained sand displays the quality of quicksand much more readily than does a coarse-grained material.

QUICKSAND IN TRENCHES

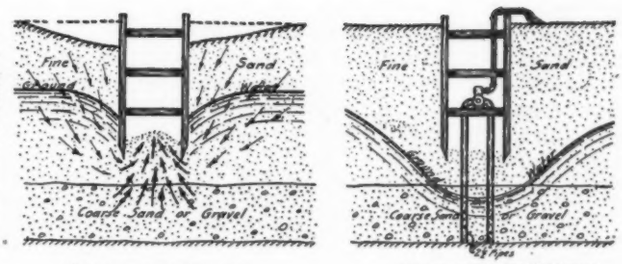
Figure 1 illustrates the unbalanced condition of ground water which occurs when an excavation is made into wet sand by the usual process. At the left is shown the assumed stratification of soil and the normal level of ground water. At the right is shown a sheeted excavation which has been carried below the ground-water level with the assistance of a pump which drains the inflow of water entering the opening. The drawing down of the water level at this point results in an unbalanced condition with respect to the surrounding ground water. That in the coarse stratum at the bottom of the section is under a pressure due to the head H. In the area immediately under the excavation, however, the upward pressure



NORMAL CONDITION OF WET SAND

UNBALANCED WATER CONDITION DURING EXCAVATION PROCESS

FIGURE 1.



BOILING INDUCED BY UPWARD FLOW FROM COARSE STRATUM BELOW TRENCH

BLEEDING COARSE STRATUM TO PREVENT BOILING

FIGURE 3.

from this stratum is resisted only by the pressure due to the head H-h, with the result that there is a flow of water upward into the excavated opening. Depending upon the velocity of this flow together with the character of the sand, there will result a condition of quicksand in the soil underlying the excavation.

If the sheeting is relatively watertight (as it must be to prevent the inflow of water and sand through its vertical joints), there may result an accumulation of water pressure immediately behind the sheeting which may produce such velocity of flow under the sheeting as to cause a break there, allowing sand to flow with the water through the passage thus formed, bringing a considerable quantity of sand from behind the sheeting and leaving a void there, which in turn is filled by the settlement of the ground above, as shown in Figure 2. This could be avoided by driving the sheeting to a greater depth in advance of the excavation. It will usually be found economical in such cases to employ matched or tongue-and-grooved sheeting, and to drive the same several feet below the required depth of excavation, in order to avoid disturbance of the adjacent banks and the removal of excessive amounts of material.

Under these same conditions an extremely fine-grained sand may assume semi-fluid tendencies due to the upward movement of water through it and there may be an upward movement of the sand into the trench so that a trench left overnight may be found the next morning to have filled up again to a depth of several feet. This tendency can be resisted by driving the sheeting deeper and by the free use of gravel or broken stone, which forms a surface layer or crust over the sand, permitting the water to escape, but preventing the numerous smaller boils whereby the sand is carried upward into the trench.

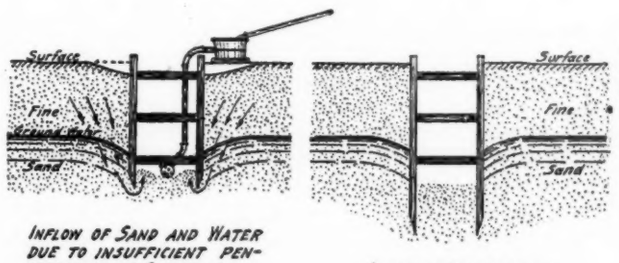
A more serious cause of trouble from quicksand is shown in Figure 3. In this case an upward flow of water from a coarse stratum below, caused by an unbalanced water head, carries the sand with it into the trench; which sand is replaced by adjacent sand on either side which flows in laterally to fill the crater thus formed. The result is a demoralizing of the surrounding ground surface and an inflow of sand through the bottom of the excavation, possibly as fast as or faster than it can be removed.

The further driving of the sheeting in such cases is ineffective unless it is carried down to the stratum of coarse material, and even then the boiling sand and water continues, although the adjacent ground is protected against undermining.

BLEEDING QUICKSAND

The most expeditious and satisfactory method for handling such cases is by means of the bleeding process illustrated in the right-hand view of figure 3. Perforated pipes or well points of sufficient size and number are driven into the coarse stratum and connected by a manifold to a pump of proper size. If the pump and well system have a capacity greater than the amount of inflow at this point, a depression can be formed in the surrounding ground water level to a point lower than the bottom of the excavation, thus permitting the latter to be carried on in the dry. This method is relatively inexpensive compared with the cost of handling a bad quicksand trench and is to be recommended whenever there occurs violent boiling from a lower level.

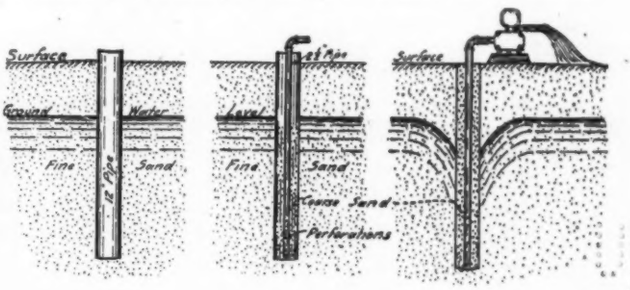
A somewhat similar but less dependable method of bleeding fine sand is shown by figure 4. Generally speaking, well points are not effective



INFLOW OF SAND AND WATER DUE TO INSUFFICIENT PENETRATION OF SHEETING, CAUSING SUBSIDENCE OF SURFACE ADJACENT TO TRENCH

INFLOW PREVENTED BY DRIVING SHEETING TO GREATER DEPTH

FIGURE 2.



METHOD OF BLEEDING FINE SAND

FIGURE 4.

be necessary to overcome the frictional resistance the excavation, however, the upward pressure

in fine sand because the amount of water that can be drained by a single point is small, due to the slow percolation through it and the fineness of the gauze screening which prevents the sand from entering the pipe. To meet this condition, large pipes of, say, 12 inches in diameter may be driven, into which smaller well pipes are inserted, the annular space between them being filled with coarse sand. If the large pipe is then removed, the coarse sand will collect the water from the fine sand while still holding the latter in place, and will readily deliver the accumulated drainage to the well points in the lower end of the well pipe. If a sufficient number of these installations are connected in a given locality, the water in the fine sand may be drawn down as in the former case.

The author described the use of the pneumatic or compressed air process in sinking excavations through fine, wet sand. The air, exerting a pressure at the bottom of the excavation, forces the water back into the soil, and fine sand which perhaps had previously boiled violently because of inflowing water may require picking for its removal. Fine, wet sand deposits which offer almost insurmountable difficulties for open excavation may usually be tunneled by the use of compressed air with the utmost ease.

Mr. Gow citied an experience which he had several years ago where an upheaval of fine sand and water in the basement of a mill building resulted in serious damage to the structure. Test boring showed that there existed at that point a surface layer of a very compact clay hardpan overlying a bed of exteremely fine sand about twenty feet thick, and immediately under this a substantial layer of coarse gravel. This gravel was filled with water under such head that it rose in the boring pipe to a point fourteen feet above the level of the basement floor and several feet higher than the natural ground level. Several six-inch pipes were driven down to the coarse stratum and clear water allowed to flow through them so freely that the ground-water head was reduced below that required to force its passage upward through the fine sand, with the result that the flow of sand ceased entirely. Incidentally an excellent water supply was secured to the mill for manufacturing purposes.

SUPPORTING POWER OF FINE SAND

Concerning the supporting power of fine sand which may become "quick" when excavated into, Mr. Gow believed that such sand in its normal condition will sustain quite as great a foundation load as will coarse-grain sand. It is probably because such sand is ordinarily seen under the unatural condition cause by excavating into it, that so many people assume this unstable condition to be its natural state, while the contrary is in reality true. He has never hesitated to recommend loadings as high as four tons per square foot upon sand which, during the excavation process, permitted the workmen to sink to their knees in it, nor has there been any observable settlement in such cases, to his knowledge. Surrounding the foundation site with tight sheeting does not, in his opinion, increase the bearing value, although it may be useful in preventing subsequent lateral displacement in the event of adjacent excavations being made. If the material is a pure sand it will not flow under pressure alone except under excessive loading, although if the sand contain a considerable quantity of clay this may not be so. A microscope may be required to determine accurately whether the finest particles are sand or clay.

The production of quicksand characteristics by introducing water under pressure may be employed to advantage in driving piles in fine sand by using the water jet method, and this is recommended for driving either bearing or sheet piles into fine sand.

SEWERS AND DRAINS

Quicksand frequently causes trouble by escaping into sewers, drains or other underground conduits, thus clogging them and producing voids in the ground which must be filled by settlement from above. Consequently any open pipe or conduit laid through wet sand should be constructed with special care to exclude the surrounding sand. When drains are laid in such material for the purpose of lowering the ground-water level, the open joints should not only be wrapped in cloth to exclude the sand, but the entire pipe should be surrounded with soft-coal cinders. Such cinders form one of the most useful agents for admitting water while still excluding the passage of sand. They are useful during the process of excavating in quicksand, a frequent liberal sprinkling of them over the bottom of the trench being found very effective in preventing the workmen from sinking into the sand.

It will be found that the ordinary garden fork is more effective for handling many quicksands than is the type of shovel usually employed, owing to the fact that fine, wet sand has a very pronounced suction which causes the blade of the shovel to stick and requires considerable force to remove it.

Another Isthmian Canal Proposed

Secretary Baker has suggested that it is time to begin planning another canal across the Isthmus of Panama, since within the next 15 years the capacity of the present canal will, he believed, have been reached. Anticipating a renewal of the discussion of lock versus sea-level canal, he speaks in favor of the latter. The two chief arguments against the sea-level canal are the additional cost and the additional time required for construction. The latter can be offset by beginning construction soon enough to permit its completion by the time the capacity of the present canal is reached; and as for cost, since the World's War a few hundred millions would not stand in the way of the construction by the American people of whatever it considered best. It is possible that the Nicaraguan route might be chosen.

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Measurement of Contract Work

One of the most important characteristics desirable for specifications is that of eliminating all opportunities for misunderstanding between the parties to the contract. Probably one of the most prolific causes of discord between engineers and contractors has been disagreement in the interpretation of certain points in the contract and specifications or in adjusting differences due to omissions.

In the case of itemized bids, it should be made perfectly clear just what is included in each item bid upon; and the sum of all the items should equal the completed work. For any part of the work not so included the contractor is entitled to additional payment as extra work, and extra work not only affords basis for dispute, but it furnishes ground for criticism of the engineer by his employer.

The above was suggested by the letter printed elsewhere in this issue, in which a contractor states that a dispute concerning payment for a sewer job has arisen because of failure of the specifications to state clearly just how manholes are to be paid for; the contractor claiming that payment for the sewer should be for the entire length from one end of the line to the other, including that under the manholes, while the engineer would deduct from the length of sewer paid for those sections which lie within the manholes. As a matter of fact, in this case it perhaps makes little difference which method of payment is adopted, providing it is made perfectly clear to the contractor before bidding just what will be the basis of payment.

In some cases exact definition of the basis of payment is omitted because it is assumed that trade or local practice determines this; for instance, the general practice of paying for brick or other masonry in house construction by the total area of wall, including windows or other openings. It is safer, however, to specifiy such matters even though they may be commonly accepted. For one reason, an outside contractor might claim truthfully that he was unfamiliar with such local custom and had bid in ignorance of it and would be injured by its application to his contract.

Another desirable characteristic of those clauses of specifications which refer to measurement of work done is simplicity and elimination of variable or uncertain conditions. This is illustrated by the case of sewer and manhole payments just mentioned. If deductions are made from the sewer length for the distance included within manholes, the length for payment would be determined undoubtedly by measuring the total length and deducting therefrom the several lengths included within manholes. This not only increases the amount of work but furnishes an opportunity for mistakes and, as we can see no arguments in favor of this plan rather than the other, the simpler one seems to us the better and wisely chosen as the standard practice.

The principle of including all items might well be carried further than it commonly is. In some contracts for trenching and other excavating work a lump sum is bid for pumping or otherwise removing ground water which may flow into the trench, while in perhaps the majority of cases no payment is made for this but the contractor is supposed to distribute its cost among the other items. The same is true of sheeting trenches in unstable soil or where the depth is excessive. In the latter case the payment is frequently made on the basis of lineal feet of trench which must be sheeted. It would seem to be equally logical to base payment for pumping or other form of de-watering on the length of excavation which requires this, on the size of pump and hours of pumping required, or some other unit which would give a more or less definite measure of the amount of work of this kind required of the contractor.

The more uncertainty there is left in a contract the more it becomes a gamble for both contractor and those paying for the work. Some men are natural gamblers, and some contractors enjoy and grow rich on gambling contracts. The average employer of contractors, however, is so only occasionally and is therefore at a disadvantage in any gamble between the two, but should in wisdom pre-

fer a straight, plain business agreement in which there will be no misunderstanding and in which both parties will secure a reasonably good bargain. Such a business agreement required that every item of work to be performed is so definitely and unmistakably described that at no time during the conduct or final closing up of the contract will any dispute arise as to its meaning.

New England Road Builders' Association

An association of firms or corporations actively engaged in road building work in New England was formed on January 13, with about 60 charter members. The meeting voted that the first duty of the executive board be to take up with the commissioners of the Massachusetts State Highway Division suggestions relative to changes and improvements in the specifications under which roads are now being built in Massachusetts. The following officers were chosen for the year 1921: Ransom Rowe, president; John F. Coleman, vice-president; Joseph A. Tomasello, treasurer; Samuel Hobbs, acting secretary. The executive board consists of the president and Joseph M. Bryne of Boston, C. B. Lindholm of Pittsfield, Arthur A. Adams of Springfield, C. J. Spalding of Worcester, J. J. Welch of Salem, C. J. Reynolds of Canton, and E. J. Rourke of North Abington. The address of the secretary is 68 Devonshire street, Boston.

New York State Highways

Although the New York State Highway administration, with the new superintendent of highways, may not see fit to adopt it, a committee appointed in 1919 has recently submitted a report for completing the state highway system, the estimated cost of which would be about $82,000,000. $53,000,000 is made available by the 1920 bond issue, federal aid, state appropriations and the counties' share of the cost of construction. The remaining $29,000,000 could be provided by direct appropriations, bond issues, or future federal aid. The system designed contemplates linking up all the roads in the state and providing 8 through routes across the state from east to west, and 21 from north to south, requiring 11,119 miles of road, of which 10,380 miles were authorized in 1917 and 8,000 of which have already been built. This would require somewhat over 700 miles of new roads to complete the system, and would require possibly six years to complete the construction.

New York Highway Commissioner

Governor Miller has appointed former state excise commissioner, Herbert S. Sisson, as New York State Highway Commissioner in place of E. S. Greene, appointed three years ago by former Governor Smith. The American Association of Engineers unavailingly petitioned the governor to put an engineer in Mr. Greene's position.

Sanitary Engineers' Dinner

Last year, at the suggestion of J. Frederick Jackson, director, Bureau of Sanitary Engineering, Connecticut State Department of Health, a group of sixteen sanitary engineers held a dinner at the Hotel McAlpin on the evening before the annual meeting of the American Society of Civil Engineers for the purpose of an exchange of views, a recital of experiences and for an opportunity to meet socially.

The affair was so enjoyable that it was decided to repeat it this year and on the evening of January 18, 1921, twenty-nine met together at the same place.

Among the many topics of live interest that were discussed informally were: The situation regarding water supply and sewerage at Athens, Greece; the experiments with a new type of Schaefer ter Meer sludge centrifuge and the use of acid in the treatment of activated sludge at Milwaukee; fine-screening at Milwaukee, Baltimore, Rochester and Syracuse; the electrolytic process at Allentown, Pa., and Elmhurst, N. Y.; the pollution of the new municipal swimming pool at Washington and, as indicated by dissolved oxygen, of New York harbor; the admission of storm water to sanitary sewers and of sewage to storm drains at Newark, etc., etc.

It was decided to establish the custom of meeting in this way and at this time every year.

Those present were: Walter E. Spear, New York City; John F. Skinner, Rochester, N. Y.; Edw. B. Besselievre, New York City; F. C. Wintermute, Wilkes-Barre, Pa.; Weston Gavett, New York City; R. H. Craig, New York City; W. H. Halsey, Southampton, N. Y.; Lynn Perry, Easton, Pa.; Amos Schaeffer, New York City; R. F. Proctor, Baltimore, Md.; Kenneth Allen, New York City; Ezra B. Whitman, Baltimore, Md.; G. L. Robinson, New York City; R. K. Tomlin, New York City; J. R. Van Duyne, Newark, N. J.; A. S. Hirzel, Wilmington, Del.; E. F. Koester, Wilmington, Del.; T. C. Hatton, Milwaukee, Wis.; A. E. Phillips, Washington, D. C.; W. Gavin Taylor, Newark, N. J.; Edw. S. Rankin, Newark, N. J.; T. J. McMinn, Bridgeport, Conn.; Geo. A. Soper, New York City; Harrison P. Eddy, Boston, Mass.; J. F. Jackson, New Haven, Conn.; R. Spurr Weston, Boston, Mass.; A. H. Pratt, Newark, N. J.; A. W. Tidd, New York City; C. L. Bogert, New York City.

A Russian-American Engineering Society

Russian engineers in the United States in 1918 founded the "Russian Engineering Society in U. S. A.," and in 1920 this became affiliated with the United Engineering Society and has its offices in the United Engineering building, 29 West 39th street, New York City. It is a purely professional organization with 91 members.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that ohters who have solved similar problems different will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How can a General Construction Organization Be Utilized During Winter Shut-Down?

Office force can investigate, design and improve; prepare, classify and tabulate data and sometimes can revise contracts. Equipment can sometimes be put on production or extra service. Mechanics can be put on Repairs and Construction.

A very important part of the general contractor's investment, whether large or small, consists of his organization and equipment, both of which involve heavy overhead and fixed charges that run day and night, involving a large constant expense, whether or not he is doing any work on which regular estimates will bring him monthly payments. In fact, not only his own time and his whole capital, but all of his obligations demand direct or indirect constant outlay or payments of some kind whether work is going on or not, and much of it cannot be avoided or diminished even if all of the work is totally suspended; so that a short period of non-compensated time seriously reduces and may eliminate the net profits for the year, even if the contracts themselves are good and conditions generally favorable.

Most contractors experience more or less dull or idle time, especially in the winter, and thereby suffer heavy losses that might be considerably reduced by careful analysis, planning and energetic action. Producers, manufacturers, dealers and most employees are busy the year around, because they recognize that they would be badly crippled or ruined by idle periods, and, if necessary, make sacrifices and strenuous efforts for continuity of business. The contractor should strive as earnestly for uninterrupted, comfortable employment for his men and plant and can secure it to a larger degree than is generally realized.

SOME YEARLY SALARIES NECESSARY

It is so difficult to secure satisfactory men for positions of responsibility, it takes so long to train them and it is necessary to have them so promptly for important work, that allowance must be made in overhead charges, distributed on estimates and bids, for keeping the best foremen, superintendents, and a few office men and sometimes first-class workmen, over the intervals between one job and another. These men will be more contented and efficient and it will be very much more profitable to the contractor, if employment be found for them than to have them idle, and there are many ways in which employment can be made advantageous, chiefly by doing necessary things that can be attended to before or after the busy construction period when time is limited and important duties are urgent.

ANTICIPATING INVESTIGATIONS

Inquiry among public officials, corporations, and former clients or their friends will often discover future work that has not yet been announced, and the contractor's estimator or assistant engineer may be able to make reconnoisance of the territory, study transportation and facilities, investigate local conditions; prospect for stone, gravel, timber, water, transportation, and even indirectly for labor; make borings; and investigate local conditions so as to make a far more intelligent bid and develop special features that could not be done in the brief time often allotted to the preparation of a bid, after the invitations have been issued. This work, of course, is a good deal of a gamble and should not be undertaken expensively unless there is strong probability of a favorable opportunity to bid in the near future.

REVISING DESIGNS

If engineers and owners can be persuaded to issue specifications and plans in advance, or to old friends confidentially, the contractor and his staff can profitably study them very critically and note wherever immaterial changes could be made so as to allow the use of materials, supplies, machinery or equipment that is cheaper, more convenient or more easily obtained by the contractor; to use different grades or sizes and eliminate small quantities, odd sizes or special materials that are difficult to obtain, or substitute an equally good article or modify some of the methods or requirements without in the least injuring the construction or the owner's interests, while it expedites the work and is advantageous for the contractor. Many of these changes, if properly presented, will be entirely acceptable to the owner and engineer, and others may be made by way of exchange, the contractor offering some concession or advantage to compensate for the favors granted him. A state of willingness to reciprocate, and an honest effort

to do first-class work, will generally be appreciated.

FINISHED AND UNFINISHED WORK

For unfinished work, future operations should be very carefully studied and scheduled and all operations listed in order, with the probable date of commencement and completion, the number of men and the plant and materials required at the given date in order to avoid all delay, confusion or interference. These data should be carefully classified and arranged and placed in a follow-up calendar showing each day what steps should be taken, arrangements made or initiated, orders given, and reports prepared to insure that everything and everybody will be in readiness without fail when required.

Orders for supplies should be ready to be mailed at the proper time and to be followed up for prompt delivery, and arrangements made for receiving, inspecting, storing and distributing the supplies. Possible difficulties should be anticipated, emergencies provided for and very careful studies made of the methods and sequence of operations and of the installation and service of the plant and equipment, which will often develop changes, arrangements, and convenient devices that will make the work safer or more rapid, will eliminate hand labor or prevent delay and loss of time. All data required in the field should be verified, arranged and tabulated in convenient duplicate form so that the foremen and superintendents can have them constantly available and refer to them instantly by inspection without stopping to make calculations in the field.

If it has not already been done, the records of previous work can be analyzed and summarized, classified costs prepared for future estimates, and in particular the time required for certain operations under given conditions and the amount of men and plant employed on it, and these recorded so as to be available for future comparison and quick estimates.

SUPPLEMENTARY WORK

If other construction work, heavy manufacturing or production is going on in the vicinity, the contractor may be able to secure sub-contracts or arrange to render special services that will keep some portion of his plant, such as derricks, hoisting engines, excavating machinery, drills, trucks and the like busy even at a small profit and thus keep the equipment and its operators employed, pay overhead expenses and avoid disorganization of his forces. Motor trucks may be utilized for transportation, commercial or industrial purposes.

If supplementary work is required for the next season's operations, much of it, like building service roads and tracks, locating, opening and operating sand and gravel pit and quarries, building camps, clearing land, grading, draining and the like can be done during the winter; timber can be framed, concrete forms built, and storage bins and other facilities constructed.

REPAIRS AND CONSTRUCTION OF EQUIPMENT

At the contractor's yard all of the plant and equipment, from steam shovels and locomotives down to hand tools, should be carefully overhauled, inspected, repaired, tested, protected and accurately listed. Worn out equipment should be disposed of and all deficiencies made good.

A few mechanics and helpers, according to the size of the organization, can usually be very profitably employed in this way and often can build special or standard equipment that is certain to be required in the near future. Timbers for wooden derricks, jinpoles, shear legs, gantries, and the like can be framed and the blacksmith can forge the necessary fittings or can modify those left over from other equipment or scrapped plant.

Dump cars, wagon boxes, buckets, skips and the like that always receive hard service and wear out rapidly, should be repaired, reinforced and put in perfect order. When the complete articles are in bad condition the uninjured separate irons and other trimmings may be removed and serve for new plant.

SHOP AND YARD FACILITIES

An available building, or if necessary a new shed, should be provided equipped with work benches, a forge, drill press, lathe, grindstone, emery wheel, bolt cutter, borer, saw, and planer, all of which, with a little care, can be secured at a very moderate price and can be operated by electricity, by a gasoline motor, or even in case of necessity, from a shaft driven by an engine of an automobile truck. With such an outfit wood work can be done right and simple iron work can be done promptly and cheaply that would be very slow and expensive if sent to a machinist; new ideas and convenient devices can be worked out practically, and much time and money saved.

In such a shop small sectional wooden buildings can be manufactured ready to put together for field offices and store rooms; simple trusses, templates, batch boxes and arch centers can be built, trestles and runways prepared, tool boxes built and filled and small tools and supplies examined and sorted, prepared and stored to great advantage.

Dry, safe yards should be provided, close to a railroad siding, if possible, with loading facilities. skids and shelters for storing heavy plant and equipment on interrupted jobs or at headquarters or at sub-stations in remote places where plant is held for sale or re-shipment. The mechanical apparatus should be safe from thieving and mutilation, under cover or, if necessary, protected by heavy tarpaulins. Lumber and timber, including derricks and framed plant, should be protected from rain, kept away from contact with the soil, and provided with abundant ventilation and exposure to wind and light.

Irrigation Project for Manila

The Philippine government is contemplating issuing $25,000,000 in gold, non-taxable, 20-year, 3½ per cent bonds for irrigation and other public works, conditioned upon the permission of Congress. The chief object would be the construction of extensive irrigation and flood control works in Luzon and some of the other islands.

Payment for Sewer Manholes

Customary methods of estimating amounts due contractor for sewers and manholes.

Editor, PUBLIC WORKS,
New York City.
Dear Sir:

What is the customary way to pay for a manhole on a brick sewer? When a contractor bids, say, $10 per lineal foot for a 6-foot brick or concrete sewer and $50 each for manholes complete, has the engineer in charge of the work a right to deduct the footage taken up by the manhole, and is his contention that a manhole means from the bottom of the brick sewer to the top of the manhole correct? The specifications or bidding sheet did not cover the point in question clearly. The contractor claims that he should be paid regular price per foot and also his $50 each for manholes, claiming that the manhole in such cases means from the top of the sewer up to and including the cover and ring.

In reply to this question from an Ohio contractor, we stated that, if the specifications and bidding sheet did not cover the point, the court would probably hold that payment would be made in accordance with customary practice and would receive evidence as to what such practice was in that section of the country. While there may be practice in that particular locality at variance with that of the country at large, we believe that the latter is very generally in favor of the contention of the contractor. The very general practice, we believe, is to make measurements of all sewers continuous, whether these sewers be small pipe sewers or large brick or concrete ones.

As to the method of paying for manholes, not so great uniformity seems to obtain, although in probably the majority of cases the plan is to pay for the manhole a lump sum either for all masonry or for the masonry and iron top combined; or in some cases to pay a lump sum for a minimum height of manhole, plus a stated sum for each additional foot, the height being measured from the top of the manhole masonry to the invert of the sewer

Standard specifications for sewers have been adopted by the American Society for Municipal Improvements, the committee preparing them being also members of the committee on sewer specifications of the American Society for Testing Materials. These specifications state definitely how the sewers shall be measured, giving separate specifications for brick, concrete and pipe sewers; and in each of these cases it calls for continuous measurement without any deduction for manholes or other structures. For concrete sewers, the specifications for measurement read: "The length of concrete sewers will be determined by measurements along their inverts parallel to their center lines. No deduction will be made on account of openings at branches and manholes." Under the head of brick sewers it is specified that "The measurement of brick sewers shall in all respects conform with the requirements hereinbefore specified for concrete sewers." The specification for measurement of pipe sewers reads: "The length of pipe sewers to be paid for will be determined by measurement along their invert lines, and no deduction will be made on account of openings at manholes."

In these specifications the bids for manholes are supposed to be a lump bid for the manhole complete, so that no specifications are given for measurement.

In the matter of branches, either branch sewers or house connections, the specifications are as explicit as for sewers. For brick or concrete sewers it is specified that "The measurement of a branch concrete sewer will be made from the inner surface of the wall of the main sewer to which it connects. A reducer will be paid for at the contract price for the sewer at the larger end thereof." In the case of pipe sewers, measurements of branch sewers are not dealt with, but the practice of the writer and most other engineers with whose work he is familiar is to begin the measurement of each branch from the center of the manhole where it joins the main sewer. The A. S. M. I. specifications specified in the case of basin connection, that "the length of such connections paid for will be the total length measured along the invert of the connection." In the case of house connections, "They shall be measured from the hub of the spur attached to the drain, sewer or riser."

The above practice as to measurement of sewers would seem to be best from several points of view. It simplifies the estimate and avoids the necessity of making allowances which might easily give rise to dispute between engineer and contractor. In the case of pipe sewers, with the manhole already built, there is still additional work connected with adjusting the sewer to the inlet and outlet sides of the manhole which adds at least as much to the cost of construction as would the laying of the 5 or 6 feet of sewer which the manhole displaces. In the case of a brick or concrete sewer, the special work connected with facing the opening in the arch of the sewer over which the manhole is placed and making a strong joint between the manhole and the arch of the sewer generally adds as much to the contractor's cost as is saved by the material omitted from the sewer arch at the manhole.

After all, however, the important thing is to have it stated definitely and without possibility of misunderstanding just what is to be included in the payment for the sewer and what in the payment for the manhole, and the contractor can then adjust his prices for manholes to meet this understanding. Any specification which fails to make such definite provision for payment for manholes, basins, house and other connections, spurs and branches of all kinds, and all other appurtenances and additions to the uniform and continuous sewer conduit, is only inviting a dispute between engineer and contractor which tends to keep alive the unfortunate antagonism too often found between these two classes of men who should co-operate toward the securing of the best possible construction of our public works.

Recent Legal Decisions

NEWS STANDS AS OBSTRUCTIONS IN CITY STREETS

In a decision holding that news stands 2 feet wide on sidewalks in the city of Buffalo, though attempted to be authorized by the city, are unlawful obstructions, the New York Appellate Division, People v. Buck, 193 App. Div. 262, 184 N. Y. Supp. 210, states that it is elementary law that the public is entitled to the free and unobstructed use of the city streets, and that any obstruction of such streets for private use interferes with the public right, constitutes a nuisance, and may be removed at the suit of the interested citizen. There are certain exceptions to this general statement, as where there are temporary obstructions, or obstructions which the courts have considered as not amounting to a substantial interference with traffic, and as permissible and not in conflict with the purposes for which streets and highways are maintained. It is stated in elementary works on Municipal Corporations to be a diversion of the public streets for private use to permit them to be used for news stands. The primary purpose of streets is for the use of the public for travel and transportation, and any private obstruction or encroachment which interferes with such use is a nuisance.

Under these general rules it has been repeatedly held that storekeepers cannot use any part of the sidewalk for their showcases, show windows and other like purposes, as the right of the public is absolute and paramount, and the public has the right to the use of the entire street. There are exceptions, of course, as where the obstructions are for a public use, like hitching posts, stepping stones, watering troughs and things of that kind. In the present case the defendants to the action of mandamus requiring the removal of 25 news stands from the public streets of Buffalo based their argument chiefly upon the proposition that news stands have now become a public use, or a public benefit, which justifies their existence upon public streets.

The Appellate Division based its decision upon the authority of the only case in the state of New York which had been cited by counsel, or which the court had been able to find, involving the question of the legality or illegality of a news stand upon a public street. That is the case of People ex rel. Pumpyansky v. Keating, 168 N. Y. 390, 61 N. E. 637. That was a holding of the New York Court of Appeals that a municipality could not legally grant a permit for the erection and maintenance of a news stand upon a public street, except in accordance with the provisions of the statute which authorizes the common council of the city of New York to grant permits for the erection of news stands under the stairways of elevated railroad structures, a space already appropriated to the use of the railroad, and from which the public were excluded.

SUBCONTRACTOR'S RIGHTS UNDER CONTRACTOR'S BOND

The New Hampshire Supreme Court holds, William H. Tower & Co. v. Long, 111 Atl. 311, that where a contract for city improvements requires the contractor to furnish a bond for faithful performance, a provision in the bond, requiring the contractor to pay for all labor and materials furnished, is binding on the contractor and his surety, though it was not contained in the original contract. The city has authority to require the insertion of such a clause in the bond for its own protection, if for no other reason, without express statutory authority. Those who have furnished materials used in the construction of public works, and for which the principal contractor has not paid, have the right to enforce payment under the bond by action directly against the bondsmen, although they had no knowledge of the promise when made, or had not expressly assented thereto before bringing the action, and the right to enforce such contract for their benefit continues while the bond is in force.

MUNICIPALITY'S POWER TO SELL DISUSED PROPERTY

A municipal corporation may be the owner of two classes of property. One class includes all property essential to, or even convenient for, the proper exercise of municipal functions and corporate powers. The other class includes all property held for general convenience, pleasure, or profit. The corporation has usually power to dispose of the latter class of property. As an authority says: "Municipal corporations possess the incidental or implied right to alienate or dispose of the property, real or personal, of the corporation, of a private nature, unless restrained by charter or statute." A Dillon on Municipal Corporations, par. 901. The Arkansas Supreme Court, Fessell-Graham, Anderson Co. v. Forrest City, 224 S. W. 745, holds that a city has authority to sell a lot with a two-story brick building on it, which has been used as a city hall and for other municipal purposes, but which has been abandoned because, on account of its location and physical condition, it can no longer be used to advantage or with economy for such purposes.

LIABILITY OF SUBSCRIBERS TO HIGHWAY FUNDS

The Michigan Supreme Court holds, North Star Township v. Cowdry, 179 N. W. 259, that a subscriber to a highway fund was estopped to question the power of the township to spend the money in connection with certain money of its own; the money having been expended on the designated improvement, and all other subscribers having paid. One who has received benefit under a contract with a town cannot escape payment therefor on the ground that the contract was ultra vires.

NEWS OF THE SOCIETIES

Jan. 31-Feb. 4—ROAD SCHOOL, WISCONSIN HIGHWAY COMMISSION. 10th annual meeting. Madison.

Jan. 31-Feb. 5—NATIONAL BRICK MANUFACTURERS' ASSOCIATION AND COMMON BRICK MANUFACTURERS' ASSOCIATION OF AMERICA. Joint meeting. Hotel Pennsylvania, New York City.

Feb. 1 — CLEVELAND SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Cleveland Engineering Society's rooms.

Feb. 1-2—NEW YORK STATE ASSOCIATION OF BUILDERS. Convention. Rochester, N. Y.

Feb. 2—SOCIETY OF AUTOMOTIVE ENGINEERS. Hotel Morrison, Chicago.

Feb. 1, 2, 3 — ONTARIO PROFESSIONAL MEETING in conjunction with the annual meeting of the Engineering Institute of Canada. Toronto.

Feb. 4 — CANADIAN SECTION, AMERICAN WATER WORKS ASSOCIATION. 1st general meeting. King Edward Hotel, Toronto. Secretary-treasurer, H. G. Hunter, Montreal.

Feb. 7—PORTLAND, OREGON SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Feb. 7-8—FLORIDA ENGINEERING SOCIETY. Annual meeting. Lakewood, Fla.

Feb. 8—BOSTON SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Feb. 9-12 — AMERICAN ROAD BUILDERS' ASSOCIATION. Eighteenth annual convention, eleventh American Good Roads Congress and twelfth National Good Roads Show, Coliseum, Chicago, Ill.

Feb. 10—SOCIETY OF AUTOMOTIVE ENGINEERS, Hotel New Southern, Columbus, O.

Feb. 11-12 — ENGINEERING SOCIETY OF WISCONSIN. Annual meeting, Madison. Secretary, Leonard S. Smith, Madison, Wis.

Feb. 14-16 — NATIONAL CIVIC FEDERATION. 21st annual meeting, Hotel Astor, New York.

Feb. 14-16 — AMERICAN CONCRETE INSTITUTE. Annual meeting. Auditorium Hotel, Chicago, Ill. Secretary, Harvey Whipple, New Telegraph Building, Detroit, Mich.

Feb. 16-18 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Seventh midwinter convention. Engineering Societies' Building.
TION, AMERICAN SOCIETY OF New York City.

Feb. 23—NEW YORK SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Meeting postponed from Feb. 16.

Feb. 28 — PHILADELPHIA SECMECHANICAL ENGINEERS. Engineers' Club of Philadelphia.

Feb. 28 — CHICAGO SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

March 14—AMERICAN ASSOCIATION OF ENGINEERS. The third annual railroad conference. Chicago.

April 27-29—UNITED STATES CHAMBER OF COMMERCE. 9th annual meeting. Atlantic City, N. J.

May 9-11—AMERICAN ASSOCIATION OF ENGINEERS. 7th annual convention. Buffalo.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne ,Ind.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10, 1921—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland, Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

Oct., 1921—IOWA SECTION, AMERICAN WATER WORKS ASSOCIATION. Seventh annual meeting. Omaha, Neb.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The annual meeting of the American Society of Civil Engineers opened on January 19, at the Engineering Societies building, New York City, with President Arthur P. Davis in the chair. The meeting opened with the report of the board of direction, after which the following members to the nominating committee were elected to serve for the coming year: W. T. Chevalier, A. L. Johnson, J. H. VanWagenen, George H. Tinker, F. E. Weymouth, J. H. Brillhart and T. H. Menas. The following committees then reported in detail—the committee on the bearing value of soils, represented by R. A. Cummings; the committee on stresses in railway track, by Prof. A. N. Talbot; the committee on highway engineering, by H. Eltinge Breed; and the committee on bridge design and construction, for which a progress report was given by H. B. Seaman.

It was voted to discontinue the board of external relations, and to have matters of external relations handled by the board of direction sitting as a committee of the whole and that local committees be named to work with the board members in their districts, in order to secure co-ordinated action. The committee on the revision of the constitution was continued and instructed to present its report in time for the next annual convention.

It was announced that the board of direction had accepted the offer of the *Engineering News-Record* to contribute $2,000 for the establishment of a memorial to Arthur M. Wellington, an award to be made each year for the best paper submitted on any subject relating to transportation. Prizes were then awarded for papers published by the society from January, 1918, to May, 1920, inclusive.

The following officers were elected: President, George S. Webster, of Philadelphia; vice-presidents, E. E. Wall, of St. Louis; Andrew M. Hunt, of New York; and Frank G. Jonah, of St. Louis; treasurer, Otis E. Hovey, of New York; and directors, district 1, John P. Hogan, New York; Ira W. McConnell, also of New York; district 4, Richard L. Humphrey, Philadelphia, Philadelphia; district , Baxter L. Brown, of St. Louis; district 10, Frank T. Darrow, of Lincoln, Neb.; and district 11, George G. Anderson, of Los Angeles.

SAN FRANCISCO SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS

At the annual meeting of the San Francisco section of the American Society of Civil Engineers, the following officers were elected for the ensuing year: President, F. R. Muhs; vice-president, Thomas H. Means; secretary-treasurer, Nathan A. Bowers. At this meeting the following addresses were delivered: "Economic Aspects of the Present Situation," by Wiggington E. Creed; "Modern Hydraulic Equipment," by E. C. Hutchinson; and "Successful Methods on Rush Construction," by Rex C. Starr.

ILLINOIS SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS

At a meeting on January 13, the Illinois section of the A. S. C. E. elected C. B. Burdick president for the ensuing year. J. N. Hatch was elected vice-president for two years. The other officers, A. J. Hammond, vice-president, and W. D. Gerber, secretary-treasurer, each have another year to serve.

PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The Philadelphia section of the A. S. M. E. held a meeting on January 21 in the form of a symposium of Hydro-Electric Power and Distribution, held under the auspices of the Engineers' Club of Philadelphia and the Philadelphia section of the A. S. M. E., A. S. C. E., and A. I. E. E.

The following subjects were discussed: "The Modern Hydraulic Turbine," by Frank H. Rogers; "The Application of a New Method of Water Measurement in the Efficiency Tests of the 37,500 h. p. Turbines of the Niagara Falls Power Co.," by Norman R. Gibson; "Surges in Conduits and Other Hydraulic Problems," by Raymond D. Johnson; "The Present Trend of Hydraulic Turbine Development," by Lewis F. Mood; "Niagara Falls Power Development and Its Products in Philadelphia," illustrated by moving pictures, by John L. Harper; and "Electrical Features of Hydro-Electric Power," by David B. Rushmore.

AUTOMOTIVE ENGINEERS

The annual meeting of the Society of Automotive Engineers was held in New York January 11-13, routine business was transacted, papers and discussions presented before different sections on body engineering, commercial aviation, and chassis. There were also held sections of aeronautic engineering, fuel and highways. A carnival and a dinner in the grand ballroom of the Hotel Astor. The standard committee made reports under headings of aeronautics, ball and roller bearing, electric transportation, electrical equipment, engines, miscellaneous, motorcycle, non-ferrous metal, radiators, tires and rims, tractors and trucks. Future meetings were announced at the Hotel Morrison, Chicago, February 2, and at the Hotel New Southern, Columbus, O., February 10.

CALIFORNIA MUNICIPAL LEAGUE

At the meeting in Bakersfield, Cal., on December 16, of the San Joaquin Valley Municipalities Branch of the California Municipal League, Mayor W. F. Toomey of Fresno was elected president, Mayor Harry Hawley of Delano was elected vice-president, and Mayor Isaac Clark of Visalia was made secretary-treasurer.

AMERICAN ASSOCIATION OF ENGINEERS

A report just issued by the service department of the A. A. E. shows that it placed 3,243 engineers in positions during 1920. The lowest salary paid by any position filled was $125 a month; the highest $15,000 per annum. The average salary of positions filled was about $200 a month; and the total annual salary for all positions filled during the year about $8,500,000.

A resolution was adopted by the society approving the efforts of the state highway department toward the supervision of the construction of roads and its declaration of the necessity of engineers being employed in highway districts only after approval of the department.

The Arkansas Engineering Society, which, on January 17, voted unanimously to make application for a charter as a chapter of the A. A. E., has prepared an engineers' license law for introduction before the Arkansas legislature.

ASSOCIATED ENGINEERING SOCIETIES OF ST. LOUIS

The Engineers' Club of St. Louis, and the local sections of the A. S. C. E., A. S. M. E., A. I. E. E., A. I. M. M. E. and A. S. R. E. have united and formed the Associated Engineering Societies of St. Louis, modeled along the lines of the Federated American Engineering Societies. The society was given permanent form at the first meeting of the joint council, composed of two delegates from each of the member societies, held at the Engineers' Club of St. Louis on January 5. H. W. Eales, president of the Engineers' Club of St. Louis was elected president; and W. W. Horner, chief engineer, sewers and paving, St. Louis, was elected vice-president.

KENTUCKY ENGINEERS' CLUB

The Kentucky Engineers' Club was organized on December 20, and the following officers elected: President, C. W. Lovelle; vice-president, V. P. Ligon; secretary, W. M. Jarvis; and treasurer, W. O. Snyder.

THE ENGINEERS' CLUB OF PHILADELPHIA

On Friday, January 21, a "Symposium on Hydro-Electric Power and Distribution" will be held under the auspices of the Engineers' Club of Philadelphia and the Philadelphia sections of the American Society of Civil Engineers, the American Institute of Electrical Engineers, and the American Society of Mechanical Engineers.

Technical session at 2:45 p. m. and general session at 8 p. m., will be held in the auditorium of the Manufacturers' Club.

Informal dinner at 6:30 p. m. at the Bellevue-Stratford Hotel. Dinner tickets ($2.50) can be obtained at the Engineers' Club.

The program of the meeting includes:

"The Modern Hydraulic Turbine" (illustrated), by Frank H. Rogers, hydraulic engineer, I. P. Morris Department, the William Cramp & Sons Ship and Engine Building Company.

"The Application of a New Method of Water Measurement in the Efficiency Tests of the 37,500 h. p. Turbines of the Niagara Falls Power Company" (illustrated), by Norman R. Gibson, hydraulic engineer, the Niagara Falls Power Company, Niagara Falls, N. Y.

"Surges in Conduits and Other Hydraulic Problems" (illustrated), by Raymond D. Johnson, consulting engineer, New York City.

"The Present Trend of Hydraulic Turbine Development" (illustrated), by Lewis F. Moody, consulting engineer, I. P. Morris Department, the William Cramp & Sons Ship and Engine Building Company.

"Niagara Falls Power Development and Its Products in Philadelphia" (illustrated), by John L. Harper, vice-president and chief engineer, the Niagara Falls Power Company, Niagara Falls, N. Y.

Colored moving pictures covering power house equipment at Niagara, scenic views of upper rapids, the cataracts, Goat Island, etc., construction views of the new 100,000 h. p. extension and the erection of the world's largest hydro-electric units.

"Electrical Features of Hydro-Electric Power" (illustrated), by David B. Rushmore, chief engineer, Power and Mining Department, General Electric Company, Schenectady, N. Y.

KANSAS ENGINEERING SOCIETY

The thirteenth annual convention of the Kansas Engineering Society was held at Topeka, on December 16 and 17. The most important feature of the meeting was the appointment of a legislative committee to introduce in the Kansas legislature laws making the registration of engineers compulsory. The principal speakers at the meetings were Chancellor E. H. Lindley, of the University of Kansas, who spoke on "Human Engineering"; P. F. Walker, dean of the school of engineering, Kansas University; F. M. Veatch, who reported on sewage; H. S. McFadden, Topeka, on highways; D. L. Hammond, on masonry and concrete; W. E. Baldry and P. L. Brockway, on the use of paving materials; L. E. Conrad, on surveys; and C. A. Haskins, on water works. F. W. Epps, of the State Highway Department of Kansas, read a paper on "Bridge Development in Kansas." Plans for organizing a Kansas section of the American Society of Civil Engineers were begun by the members of the national society attending the state convention. A committee was appointed for this purpose. The new officers elected were: President, Dean P. F. Walker; vice-president, Lloyd B. Smith, Topeka; secretary, J. M. Averill, Topeka; members of the state engineering council, J. W. Mavity, Wellington, A. E. Noble and Norton; and Lloyd B. Smith, member of the American Engineering Council.

UTAH SOCIETY OF ENGINEERS

The Utah Society of Engineers at a recent meeting vigorously favored the development of arid lands, the use of flood waters and the further development of irrigation in Utah in general. The plan was outlined by A. F. Parker, chief engineer of the Utah Water Storage Association, in a draft of a bill which it is hoped will be brought in some form before the next Utah legislature. The bill would create a state development service, following the suggestion of the United States Reclamation Service.

NATIONAL CONFERENCE ON HIGHWAY TRAFFIC REGULATIONS

The delegates from thirty national and regional organizations at the National Conference on Highway Traffic Regulations, held in Washington on January 10-12, failed to agree in a specified form of uniform vehicle law presented by a drafting committee which met in Washington and prepared this law—the net result of the meeting being the endorsement of "general principles," which were a practical duplication of the uniform law prepared last year by the Joint Committee on Uniform Vehicle Laws. It was soon found that the diverse interests represented could come to no agreement, so the committee on future activities recommended that the conference adopt only general principles for a uniform vehicle law, that no final vote on the proposed law be taken, and that the conference should adjourn with no provision for future meetings.

IOWA SOCIETY HOLDS SUCCESSFUL MEETING

The Iowa Engineering Society's 33d annual meeting which was held in Des Moines January 18, 19 and 20, was the most successful meeting in every way which the society has held. This meeting was attended by 327 engineers and 40 manufacturers' representatives. In addition to these, the wives of 45 engineers outside of Des Moines attended the convention and enjoyed the entertainment which was specially provided for them.

The technical program was carried out substantially as announced in PUBLIC WORKS, January 22.

The following officers were elected for the ensuing year: Professor John H. Dunlap, of Iowa City, president; Alvin Le Van, of Des Moines, vice-president; J. D. Wardle, of Cedar Rapids, director, and Lloyd A. Canfield, of Des Moines, secretary-treasurer.

WEST VIRGINIA ROAD BUILDING CONTRACTORS' ASSOCIATION

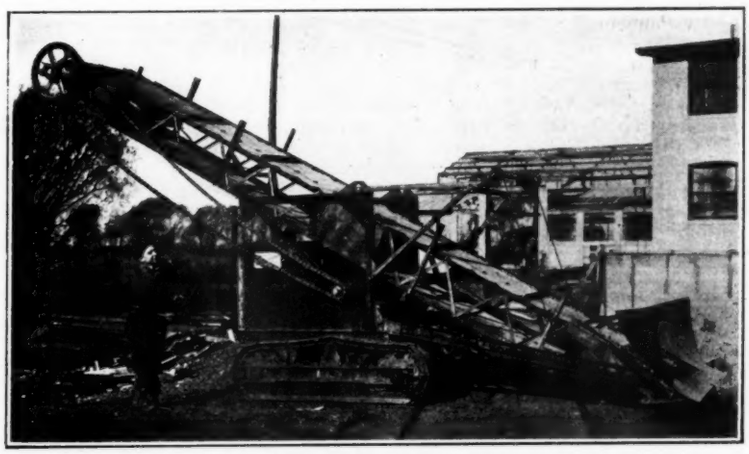
Road contractors from various sections of West Virginia and Ohio met in Wheeling on December 27 and formed the West Virginia Road Building Contractors' Association. The following temporary officers were elected: J. P. Mumaw, president, and T. J. Bartrue, secretary and treasurer.

ALBANY SOCIETY OF CIVIL ENGINEERS

At a meeting on December 21, the Albany Society of Civil Engineers elected the following officers: President, Alexander R. McKim; vice-president, Walter H. Mansfield; second vice-president, C. H. Wood; third vice-president, Joseph A. Murray, Jr.; secretary-treasurer, John W. Henry; and librarian, Carl O. Ullrich.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



SNOW LOADER MACHINE, WITH CATERPILLAR TRACTION. SIDE PLATES REMOVED.

THE BARBER-GREENE SNOW LOADER

The new snow loading machine manufactured by the Barber-Greene Company, Aurora, Ill., is a powerful, self-propelling wagon loader type of apparatus designed to work continuously from end to end of a long windrow of snow turned up by plows and clear a 6-foot width of it as it advances, discharging from the elevated rear end to a succession of trucks driving under, receiving their loads, and passing on again to the dump without interruption.

It is 25½ feet long, 12 feet 4 inches high and weighs 10,000 pounds. It is mounted on crawler tractions with cast steel treads carrying chilled cast iron rollers, having a three-point suspension, the pivoted front axle, the rear axle secured to the upper frame at two points.

The rubber belt 32 inches wide and 22 feet long on centers has cleats 20 inches apart and is driven by a roller chain on each side. The snow plow has a straight up and down adjustment, scraping the pavement clean or elevating to clear obstacles. It will work in wet or dry, hard or soft snow.

It is driven by a 4-cylinder Buda gasoline engine, 3¾-inch bore and 5⅛-inch stroke. It is controlled by three levers and two hand wheels in easy reach of the operator, and has a speed of 40 feet per minute advance and 107 feet per minute reverse. The capacity is 3 cubic yards per minute and with it in a recent test at Chicago four or five men and four trucks did more work in the same time than fifty men and twelve trucks.

The machine is commended by the superintendent of streets, Chicago, who is using it for snow in winter and expects next summer to use it for loading ashes and gravel.

SPALDING 2-IN-1 ROAD MACHINE

The 2-in-1 road machine made by the Spalding Manufacturing Company is represented to save one-half the cost of handling dirt in the old way and is recommended as a great labor saver and money saver for contractors, road supervisors and road builders. It loads, hauls and spreads or dumps dirt for excavating, leveling, filling shallow places, drainage, irrigation ditching and dam building. A machine will load, haul and unload forty to sixty loads per day when operated by one man and a four-horse team, doing the work requiring four men and eight horses with scrapers.

It is claimed that it will load 1½ yards of unplowed dirt in 30 seconds and will handle sand, gravel, dirt or fine crushed stone. The machine is provided with an adjustable tilting cutting blade and two side blades that loosen the soil and deliver it to an inclined elevator that carries it up to a galvanized steel wagon box having a bottom composed of an endless distributing belt made up with transverse slats. The machine at rest is dumped by a foot lever and ratchet arrangement and is provided with a special steering device that enables it to turn in an 18-foot circle.

AUSTIN MODEL 6 EXCAVATOR

The Austin Machinery Co., in catalog No. 6, illustrates and describes an excavating machine mounted on caterpillar traction that, with different boom and bucket fittings, can be used as a drag-line excavator, as a steam shovel, as a railroad ditcher, or with a clam-shell bucket or a skimmer bucket, or as an ordinary locomotive crane or with a magnet hoist.

The principal features of construction include a turntable 5 feet in diameter, hoist drum 12¼ inches in diameter, boom suspension control operated by drum geared to main machinery, double-cone, spiral control, spring release drum clutches, 12-inch friction disks type inside band, swing clutches and a four-cylinder gasoline-type marine enclosed, heavy-duty engine with large fly wheels. The turntable and center are made in one piece, and multipedal traction is made with special pressed steel units with a combined area reducing the load on the ground to 5¾ pounds per square inch. The machine burns from 35 to 45 gallons of kerosene or distillate in ten hours and has traction speeds of ½ mile and of 1¼ miles per hour, drag-line or hoist-line speed of 110 feet per minute, single hitch, and swing speed of 3½ r. p. m., giving it a capacity of 300 to 600 cubic yards in ten hours with a ¾-yard bucket.

Used as a drag-line machine with a ½ or ¾-yard bucket and 30-foot boom, the average working speed is 1 to 3 buckets per minute and the shipping weight is 38,000 pounds. It is recommended for cleaning or enlarging old ditches or building levees, road grading and sewer excavations and for cutting trenches as small as 3-foot bottoms and 1:1 slopes.

Equipped as a steam shovel with a 6½-foot boom and a ¾-yard dipper, it is economical for all kinds of steam shovel work and has a long-handle dipper arm for the excavation of sewer trenches to a maximum depth of 14 feet. The rated capacity per hour for deep cuts is from 50 to 60 cubic yards and for shallow cuts from 25 to 35 cubic yards. The shipping weight is 35,500 pounds and the average working speed 1 to 3 dippers per minute.

When used as a railroad ditcher it is mounted on trucks with double flange rollers and can be used to advantage on a flat car or between two ballast cars. This equipment weighs 24,500 pounds and is suitable for use as a loading machine when the shovel and dipper arm are eliminated.

When equipped with a 30-foot trussed boom and a clam-shell bucket or an orange peel bucket it is efficiently operated by the two-drum control and is recommended for sewer work, gravel banks, dredging, excavating and general rehandling. It will handle coal, stone, gravel or sand at the rate of 400 to 600 cubic yards daily, and weighs 32,500 pounds.

When equipped with a skimmer bucket it will make a cut from a few inches to a foot in depth and 12 to 14 feet in width, leaving a smooth surface at any desired grade or slope and will load sand, gravel, clay and boulders up to 24 inches in diameter. It will take up and load broken asphalt pavement or any material that can be broken with a plow. It will grade from curb to curb of a 40-foot street.

ROAD CONSTRUCTION AND MAINTENANCE WITH WHITE TRUCKS

Under the above title the White Company, Cleveland, publishes a 16-page pamphlet printed on glazed paper and handsomely illustrated to show the value of the White dump trucks for

road building and maintenance, which will require a great amount of equipment for the 50,000 miles of road contemplated under Federal aid alone during the next few years.

A fleet of White trucks were used on the construction of many miles of government cantonments and military roads. Onondaga county, New York, maintains a fleet of nineteen road building White trucks and the Seiple & Wolff Construction Company, Youngstown, Ohio, which has done a great deal of road building, maintains a fleet of ten White trucks. The Gray Construction Company, road building contractors at Morristown, N. J., operates twelve White trucks which they report to be always dependable and economical to operate.

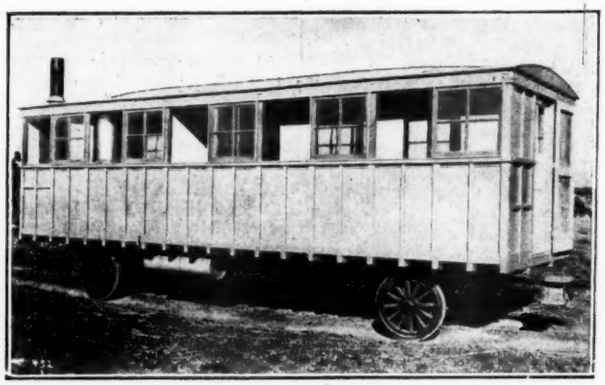
It is claimed that the operating records of White truck owners in the road constructing field show that they have lower fuel cost, are on the job more days and in the shop less days, and outlast trucks of all other makes and that they can be successfully operated under the hardest conditions doing the most work for the least money. The trucks are built of a ¾-ton light-service size, and on 2-ton, 3-ton, 3½-ton and 5-ton power dumping models.

BEST TRACK LAYER TRACTOR

The Best Sixty is a gasoline machine with caterpillar traction manufactured by the C. L. Best Gas Traction Company. The four-cylinder motor is of the valve-in-the-head type built for heavy duty. The caterpillar track is made with manganese steel spools and links and carbon steel cast shoes. They are 72 inches long and 20 inches wide and have dustproof bearings. All portions of the truck mechanism are accessible through inspection ports.

A NEW TRAILER DINING AND COOK CAR

A new dining and cook car manufactured by the Los Angeles Trailer Company, has a neat and compact design and is well built and carefully arranged to afford complete service for a movable camp, being easily hauled from place to place by an automobile, automobile truck or tractor. It was primarily designed for the use of the telephone company's field force, and has range and other complete culinary apparatus and storage provided in the rear, while the front part of the car is reserved for a dining room seating 14 persons.



DINING ROOM AND COOK CAR TRAILER

INDUSTRIAL NOTES

The Cutler-Hammer Manufacturing Co., of Milwaukee, has opened a branch office in the Railway Exchange building, St. Louis, Mo., of which Harold Phillips, recently manager of the Chicago office, will be in charge.

The Trojan Powder Co. has taken over the entire business heretofore conducted by it and its associated companies, the Pennsylvania Trojan Powder Co., the California Trojan Powder Co. and the Trojan Chemical Co., Inc.

The Chicago Pneumatic Tool Co. has appointed J. F. Huvane as eastern manager of compressor and engine sales with headquarters in New York City, and G. C. VandenBoom as western manager with headquarters in Chicago.

RAPID WORK OF AUSTIN PAVER

The 28-E Austin paver, the largest of all multi-pedal paving machines made, has established a record of completing 87 feet of concrete highway 18 feet wide in 40 minutes, equivalent to the rate of about 1 mile in five days, on a highway job in Pennsylvania.

ASPHALT PLANT EXHIBIT

The East Iron & Machine Company, Lima, Ohio, manufacturers of Merriman asphalt plants, will exhibit, at the American Road Builders' show at Chicago, February 9 to 12, a small model and will have a line of photographs to show and printed matter to hand out. The location, space 94, is close to the main entrance, and to the improved Merriman one-car railroad.

WARREN FOUNDRY & MACHINE CO.

M. L. Northrop, lately connected with the Pittsburgh Meter Company, has been appointed New England representative for the Warren Foundry & Machine Co., manufacturers of cast iron gas and water pipe, with offices at 201 Devonshire street, Boston, Mass.

NEW PIPE WAREHOUSE IN CHICAGO

The National Cast Iron Pipe Co. announces that immediately after February 1 their new warehouse plant at 37th street and South Ashland avenue, Chicago, will be in operation and will carry the largest and most complete stock of 3-inch to 24-inch cast iron pipe and specials to be found in the United States other than on the yards at a large foundry plant; also a complete line of valve and roadway boxes.

PERSONALS

Young, James, has resigned as a member of the New Jersey State Highway Commission.

Takata, K., connected with the Public Works Department of Japan, is in this country studying our methods of road building.

Washington, W. O., formerly County Engineer of Caldwell County, Texas, has been appointed highway engineer of Cameron County, Texas.

Hildebrandt, John C., who for twelve years has been connected with the Philadelphia Trust Co., has been appointed comptroller of the Pennsylvania State Highway Department.

Hands, Stanley M., formerly City Engineer of Iowa City, Ia., has organized and is president of the River Products Co., a corporation which will produce and market building and paving materials.

Crockett, J. B., has resigned as county engineer of Collins county, Texas, to enter the contracting business.

Nicholson, Maury, has been appointed highway engineer for Mobile county, Ala.

Dilling, Albert W., has been appointed chief engineer of the Sanitary District of Chicago.

McDonough, Charles J., division engineer, New York State Highway Department, died recently in Buffalo.

Philips, Hector S., who before the war was in charge of the sewer drafting section of the department of works, Toronto, has been appointed engineer of sewer design, London, Ont.

Fish, Manus J., formerly superintendent of public buildings of Boston, Mass, died on December 14 at his home in Dorchester, Mass., at the age of 61.

Hastings, George B., city assessor of Guelph, Ont., has been recommended to the city council by a special committee of council for appointment as city manager, succeeding the late T. J. Moore.

Wynne-Roberts, L. W., is now resident engineer at Chatham for the Ontario Department of Public Highways.

Murdock, R. B., executive engineer, of the Asphalt Association, has resigned.

Carpenter, L. G., has been engaged by the San Diego, Cal., water commission to furnish plans and estimates for converting Dulzura creek into a conduit, which will convey the city water supply from Dulzura to Lower Otay.

Shilton, George S., for many years engineer in charge of the collecting system of the Brooklyn water works from East New York to Massapequa, died at his home in Rockville Centre, L. I., on January 17.

Morse, Charles J., formerly commissioner of water works and fire protection of Lowell, Mass., and previous to that, commissioner of streets and highways, died at his home on December 20, at the age of seventy years.

Johnston, W. D., formerly city engineer of Waterloo, has been appointed engineer of Black Hawk county, Iowa.

Foust, Samuel M., city engineer of Connellsville, Pa., died on January 5.

Pierce, Bradford D., for about twen-